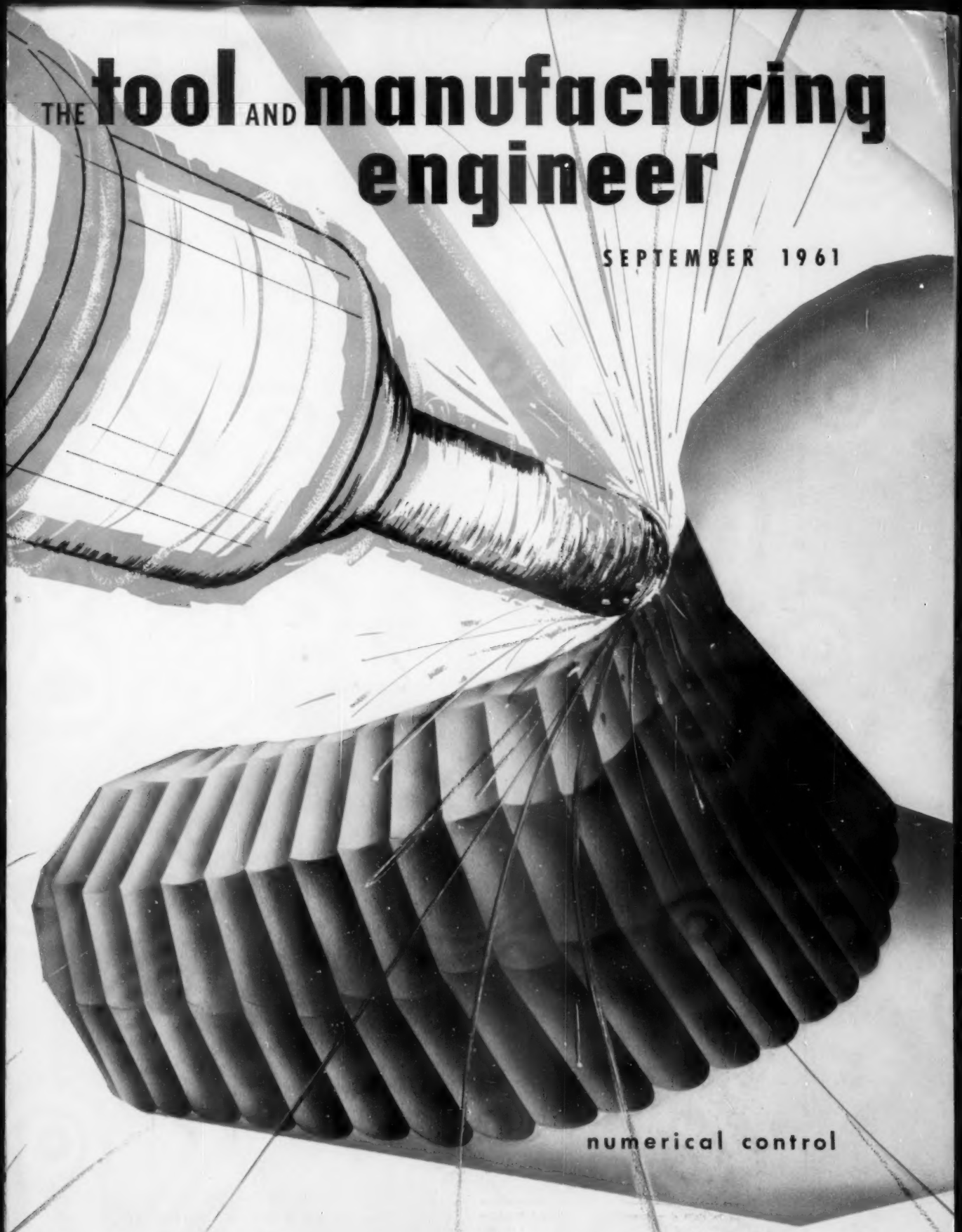
THE tool AND manufacturing engineer

SEPTEMBER 1961



numerical control

AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS

NUMERICALLY CONTROLLED DRILLING...

A short cut to a fast payoff

by Gordon Deagle
Engineer, Bore-Matic Division
The Heald Machine Company

Drilling has long been one of the simplest and most universally used operations in the machine tool field. Furthermore, of the various numerically controlled machines, the *drill* is one of the quickest to return its cost through resultant savings.

This is due largely to the fact that the increased accuracy required in most of today's drilling operations has heretofore been met by building expensive jigs and fixtures. And often these special fixtures have been made obsolete due to design changes long before they have repaid their cost through savings.

Many people think of numerical control only in terms of very high production. But with drilling this is not the case at all.

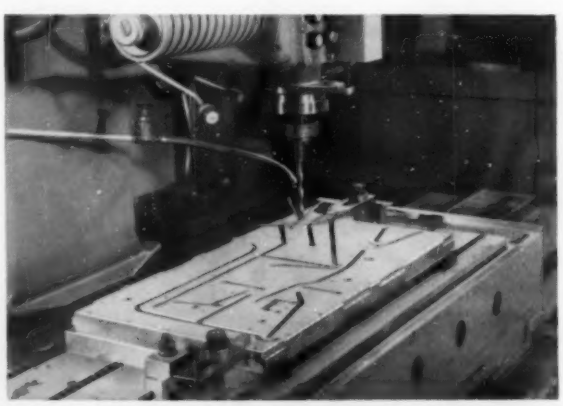
The HEALDRILL, a high-precision automatic tape-controlled drilling machine, has been profitably applied on many short run jobs involving frequent changeovers. In fact operating experience in our own drill department proves that the cost savings are even greater where small lots of many different parts are involved than on high production jobs where the expense of special jigs and fixtures might be recovered before obsolescence.

A case in point is the Heald hydraulic valve plate illustrated here in a setup on the machine. A mating pair of these plates forms a multi-channel valve panel which requires 54 drilled holes, 44 drilled and counterbored holes, and 75 holes that are drilled, reamed and tapped. All of these operations are now done on the numerically-controlled HEALDRILL and all cycle functions are fully automatic except for tool changes. Based on manufacturing in lots of 10, with a total of 200 before obsolescence of the part, the HEALDRILL method has saved $39.90 per panel over the jig method. This is a total saving of $7,980.00 on one job alone—almost 20% of the entire cost of the machine!

Hole positioning, feeds, speeds, rapid traverse and full depth limits, and drilling or tapping cycle are selected by the tape and hence are completely independent of the operator's skill, accuracy or speed. Tool changes, when required, are indicated by the machine and can be made in a matter of seconds. And total floor-to-floor time can be reduced by as much as 50 per cent. Changeover to another job requires no setup time except that required to insert a new tape in the control unit and locate the part on the table.

Preparation of the control tape for a new part is fast and relatively simple. With a HEALDRILL, sample and pilot lot production can be accomplished in days instead of weeks, and at minimum cost.

HEALDRILL in operation in drill department of The Heald Machine Company in Worcester, producing precision drilled, bored, counterbored, reamed and tapped parts for other Heald machines.



Hydraulic valve panels with 173 holes are precision drilled, counterbored and tapped on the HEALDRILL, at a saving of $39.90 per panel.

For complete information on the numerically-controlled HEALDRILL contact your Heald engineer—or send for a copy of Bulletin 2-20-48.

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THE tool AND manufacturing engineer

September 1961 Vol. 47, No. 3

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THIS MONTH'S COVER

A saddle shape is one of the most difficult to program for numerically controlled milling. Programs for this and similar shapes are now developed automatically by a computer. Details are given in one of a series of articles on numerical control's new look. The series also covers numerically controlled die sinking and inspection. See page 89.

THE TOOL AND MANUFACTURING ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index*, used generally in libraries. The magazine is available in microfilm form at moderate cost.

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Thanks to Numerical Control

Numerical control may provide one answer to survival whether we remain engaged in a cold commercial war or become embroiled in a hot shooting war. The consistent performance of tape controlled machines at higher rates of speeds and closer tolerances than those possible under manual control may be the critical factor in production.

Within a few years, numerical control has become a proved adjunct to automation but with more versatility and flexibility of application than are possible with other aspects of automation. For example, automation is associated with high-speed mass-production methods. Numerical control, however, is not necessarily restricted by the size of quantity lots other than to justify original capital investment. Even then, piece parts may vary at will, a condition not compatible with other automation methods.

Yet the vital nature of these production methods is not generally appreciated. There are many political and emotional overtones that confuse and becloud essential usefulness and added productivity available through their application. It is indeed unfortunate that misunderstanding and mistrust are playing such important parts with the results of impeding progress and causing public harm. Possibly management is guilty of greed and labor is guilty of selfish status quo motives. Whatever the reasons for misunderstanding, mutual goals must be recognized or developed to serve each.

Labor supplies basic effort. It is industry's responsibility to train and employ that effort effectively. A worker can apply his efforts to the point of fatigue without being productive. When he becomes productive, his efforts are worthwhile and he has contributed to the common good. To assure that these efforts become as productive as possible requires the knowledge and ingenuity of the tool and manufacturing engineer. Given the opportunity, he will always find the answer.

John W Greve

EDITOR

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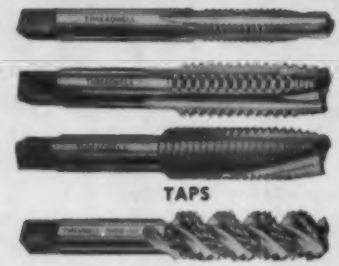
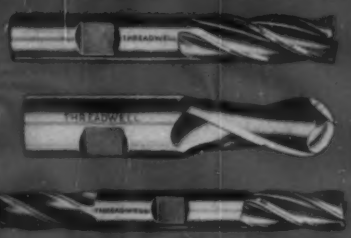
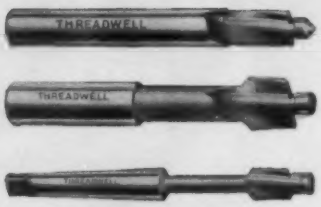


TAPS

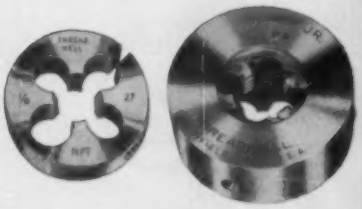
TURBO-CUT TAPS



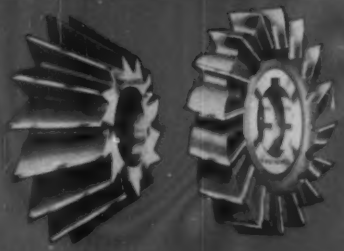
END MILLS



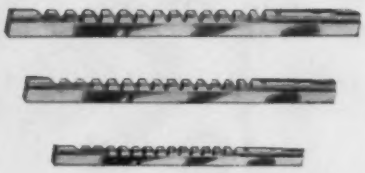
COUNTERBORES



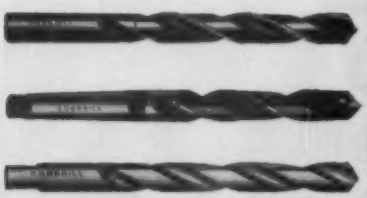
DIES



MILLING CUTTERS

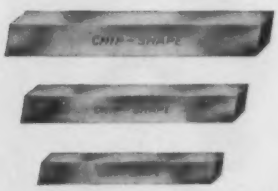


KEYWAY BROACHES

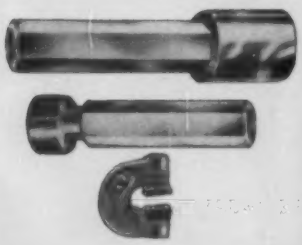


COGSDILL DRILLS

REAMERS



CHIP-SHAPE TOOL BITS



GAGES

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THE RISING HAND OF PRODUCTION

preview

. . . a fast look at this issue

Engineering Registration

Laws dealing with the registration of engineers are not written to create a professional elite; they are intended to safeguard the life, health and property of the public and to promote the general welfare. Each state registers its own engineers. Engineer Joseph B. Smith, Jr. asks whether state requirements for registration adequately reflect modern engineering science and practice in the lead article in this issue. Further, he notes wide differences between the registration laws of many states. His solution: adopt nationally recognized standards for the registration of engineers. Not all engineers will agree with Mr. Smith's arguments. Those who disagree—or agree—are invited to send their comments to the Editor. The article starts on Page 81.

Computer Designs Gears

When designing gear trains, engineers are often faced with problems such as finding the size and location of a gear that meshes with three known random gears. One way of accomplishing this job is to lay out the gear, determine its dimensions graphically and then substitute these dimensions in a series of equations involving seven variables. The solution is obtained after a couple of hours' work with a desk calculator. Kurt O. Tech, The Cross Co.'s vice president-engineering, has a better way to handle gear design problems. Briefly, he feeds data into his company's general-purpose computer and lets the computer do all of the tedious computation. This frees Cross engineers for more creative assignments and left Mr. Tech with time to write his article on design by computer, Page 87.

Numerical Control's New Look

Numerical control has now been fully proved in hundreds of production installations. Once restricted largely to contoured aircraft parts, numerically controlled contour machining is now being applied to diesinking. Result: faster machining, lower toolmaking costs. In another development, the amount of engineering time required to program numerically controlled operations has been drastically reduced by a new computer program that enables the programming engineer to "talk English" to the computer that prepares the control tape. In still another development, numerical control techniques are being used for inspection. A giant inspection machine automatically measures part contours, automatically records deviations. Time savings can run up to several hundreds of hours per complex part. Details of these new developments are given in the series of articles starting on Page 89.

Single-Point Threading

Where threading production requirements are high, modern single-point threading machines are a good bet. From a practical point of view, the life of ceramic or carbide tools is the only factor that controls productivity, since the reliability problems formerly associated with this type of equipment have been licked. Ralph L. Glaser, Man-Au-Cycle chief engineer gives the full story in his article, which starts on Page 105.

Russian Automation

Russian industry is relying on automation for dramatic increases in productivity during the next few years. Russian engineers are capable of designing excellent automation devices and automated machines. Today, however, automation is the exception, rather than the rule, in Russian plants. Russian machine tool building factories cannot keep up with the demand for automated machines. Many plants are modernizing their own equipment for more efficient production. These are some of the findings of N. G. Neuweiler, who keeps in close touch with manufacturing developments behind the Iron Curtain. His article starts on Page 111.

Small-Hole Drilling

Small-hole drilling is manually controlled in most plants and operators must be highly skilled. Small-hole drilling can now be mechanized, using a simple feed-control attachment. Operators need not be highly skilled when drill presses are equipped with the attachment, and drilling output is greatly increased. Martin Co. manufacturing engineer Sam J. Yasho describes the attachment and its application in an article starting on Page 113.

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LOOKING AHEAD

By T. W. Black
Senior Associate Editor

Several years ago, Ford Motor Co.'s Scientific Laboratory announced the development of a new type of titanium carbide cutting tool material that—on the basis of limited tests—appeared to be greatly superior to conventional materials.

Production applications since that time have amply demonstrated that the new material, which has a nominal composition of 80 percent titanium carbide, 10 percent nickel and 10 percent molybdenum, can out-perform conventional tungsten carbide and ceramics by a wide margin. Tool life 10 to 15 times longer than that obtained with tungsten carbide has been obtained on many production jobs.

Ford is licensing several companies to manufacture and market tools of the new material. The first licensee is Vascoloy-Ramet Corp., which has designated the material "VR-65." Ultimately, Ford hopes to develop several grades of the new material. It is expected that three grades will cover nearly all metalcutting applications. Die applications may be possible; experimental titanium carbide wire drawing dies are now being tried out.

✓ ✓ ✓

The range of applications of numerical control has been greatly extended during the past few months. Nu-Era Corp., for example, has introduced a tape-controlled tube bender especially for aircraft and missile applications. The machine was designed and built by Walter P. Hill, Inc., and has a General Electric Mark III numerical control system.

This is the first numerically controlled machine to have tape writer and tape reader equipment as an integral component. In aircraft work, a piece of soft tubing can be hand-fitted through the various recesses and passages in the airframe. The various twists and bends are measured and transmitted to the bendingmachine by pushing adding-machine type buttons on the machine console. As the machine makes the first part, it automatically punches a tape that can then be used to produce as many parts as necessary, all exactly like the prototype.

✓ ✓ ✓

Numerical control has also been applied to flame cutting. A machine developed by Air Reduction Sales Co. and General Electric Co., employs tape control to eliminate the need for templates, template tables and operator control. The machine cuts straight lines and contours in plate of any length, 22 feet wide and 6 inches thick.

✓ ✓ ✓

New developments such as those described above make the immediate future of American productivity a bright one. In the long run, however, that future depends on the number of qualified engineers entering industry. Freshman enrollment in engineering colleges has dropped for the third straight year, however. Unless this trend is reversed, engineers may be in short supply in the not-to-distant future.

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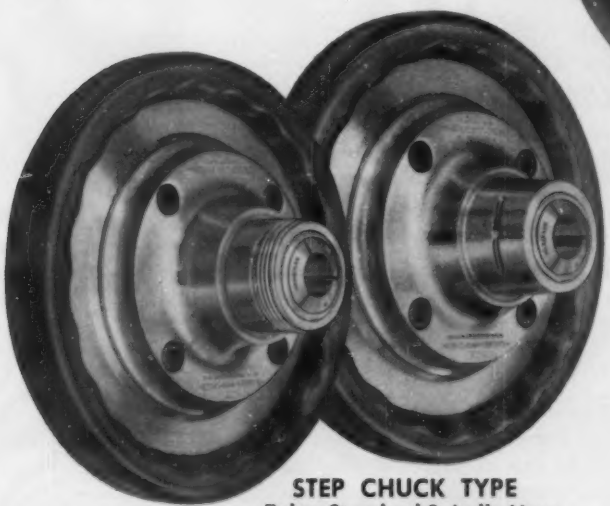

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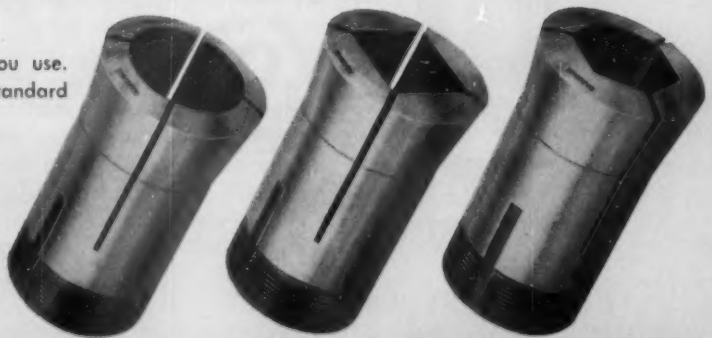

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Composite Die sections consist of fine A-L tool steel cutting edges (in all the grades you need), electrically butt welded by a special process to nonhardenable mild steel bases. Exact control of temperatures during welding and annealing gives you a bond that will not let go even under the most severe conditions.

Check these many advantages you get with Composite Die sections: You use less tool steel in your dies, and there is much less waste than with bar stock. Screw and dowel holes are easily drilled after the tool steel has been machined and heat treated—because the mild steel bases remain soft. Dowels are easier to fit, too. The back up style of assembly is not needed. Because the tool steel is reinforced and held securely by machine steel base, there is no cracking of sharp corners or long projections. There is less chance of distortion during hardening with A-L composite sections. And any slight warpage may be easily corrected without damage. You get firm, positive fit of sections on die shoes.

Salvage possibilities are also important—sections from obsolete dies can often be reused on new jobs.

Both straight and shaped sections are available with supporting ribs as needed. For more information on Composite Die sections refer to booklet FC4, a 28-page description which also covers smooth hammered **Forgings** and **Cast-To-Shape** tool steels. Ask your A-L representative for your free copy, or write: ***Forging and Casting Division, Allegheny Ludlum Steel Corporation, Ferndale, Detroit 20, Michigan, Address Dept. TE 9-1.***

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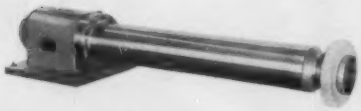
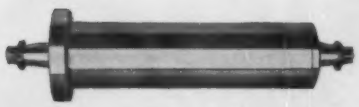
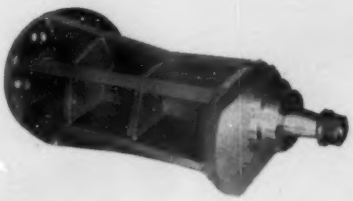


POPE P-18844 Vertical Bearing Grinder Spindle, 20 HP, 6 ft. long, 12 in. dia. barrel; weight approx. 4000 lbs.



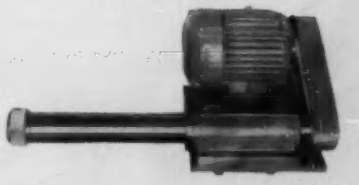
POPE P-1076 Cylindrical Grinding Spindle, designed for crush dressing and form grinding; 5 ft. long, 10 in. dia. barrel, for 24 in. dia.; 4 in. wide wheel; weight about 1250 lbs.

POPE P-18842 Deep Hole Internal Grinding Spindle, 10 HP, 7 ft. long, 12 in. dia. barrel; weight 4000 lbs.



POPE P-1098 Heavy Duty Internal and External Grinding Spindle, 50 HP, for wheel of 30 in. dia. and 12 in. width; weight approx. 6000 lbs.

POPE P-A1 Deep Hole, Ram Type Grinding Spindle attached to boring machine, 10 HP, 10 ft. long, 10 in. dia. barrel; weight 2000 lbs. (For purposes of comparison, a Pope P-32 6″ x 18″ Surface Grinder Spindle is shown in the foreground.)



POPE P-5794B Motorized Deep Hole Grinding Spindle, 10 HP, 36 in. long, 6 in. dia. barrel, for use in horizontal or vertical position on boring mills or planers; weight about 800 lbs.

POPE P-10009E Motorized Deep Hole Grinding Spindle, 5 HP, 36 in. long, 5 in. dia. barrel; weight 600 lbs.

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profitable: To hold costs in line on short runs while maintaining the highest degree of accuracy, GRAY horizontal boring, drilling and milling machine is the greatest money maker in the field, proving that Quality doesn't cost — it pays.

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horizontal milling and boring machines
planers
planer type milling machines

Use Reader Service Card. CIRCLE 13

RAY
GRAY
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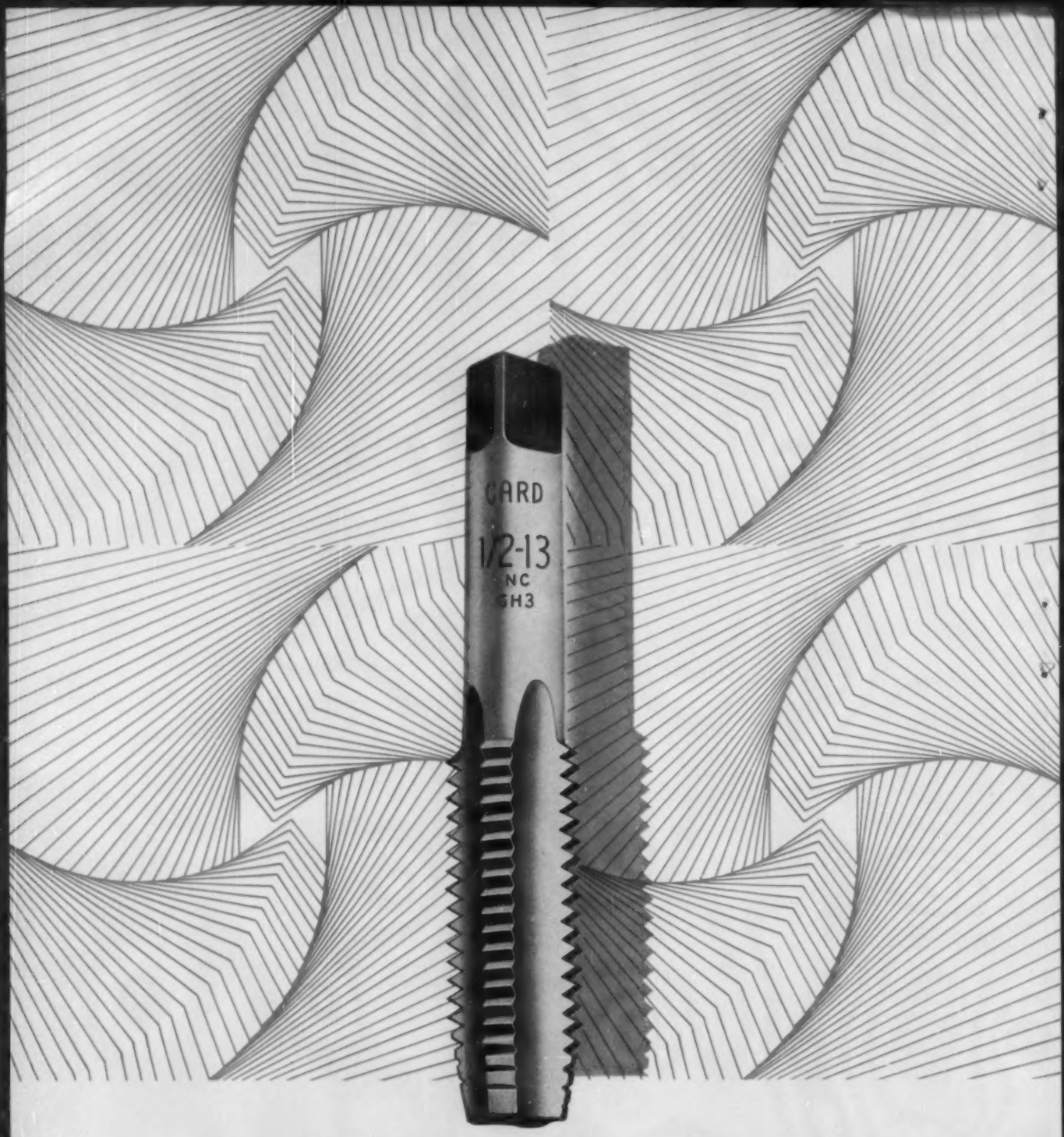

TAPS

DIES

GAGES

SCREW PLATES

PRECISE DUPLICATION can be visualized on a drawing board, by plotting geometric progressions. But to make this symbol a cutting tool reality calls for expert engineering. Engineering of this sort duplicates CARD tools precisely. CARD tools from best distributors, and valuable advice from CARD technical men are available from coast to coast. S. W. CARD DIVISION, Union Twist Drill Company, Athol, Mass. CARD Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, and San Francisco.

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HOBS
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20.1.1

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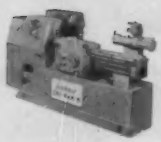
to help you

MACHINE AND THREAD AUTOMATICALLY



M-D Blowers, Inc. saves time, space and cuts costs 70%

How many chuckings would you need on your present equipment to machine and thread the port fitting on the cast iron internal pipe flange shown at right? M-D Blowers, Inc., Racine, Wis., did it in two . . . now they do it in *one* automatic operation on a CRI-DAN B!

The CRI-DAN Automatic Threading Lathe was designed primarily to cut top quality threads in minimum time using an inexpensive single-point carbide tool. Now, you can add accessories that combine threading with facing, turning, boring or tracing during the automatic cycle for extra savings.

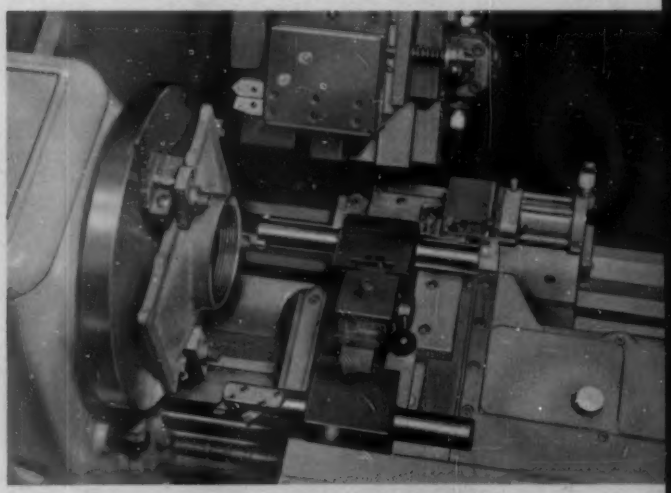
A 5" flange in face plate fixture. Rear facing slide faces hub end and chamfers O.D. with automatic tool relief. Cross slide feed is disengaged while pusher is used to bore a ¾" per foot taper for 1 ⅛" and chamfer the I.D. (pre-set boring bar in quick-change holder shown in foreground). Boring bar is replaced with threading tool and cross slide feed is engaged. An 8 TPI single-start 5.563" major diameter 60° pipe thread is generated in 16 automatic passes in 5.5 minutes f.t.f. Time on 4" flange is 3.5 minutes f.t.f.

Here is the extra equipment used to provide this flexibility for the pipe flanges—a face plate fixture; a facing slide; a facing tool block with automatic relief; a pusher device for boring from the longitudinal slide (or turning for other parts); a dove-tail tool block for the threading cross slide that permits fast interchange of pre-set boring and threading tool holders. *Tapers do not require special equipment.* Shafts are handled with an air chuck, a tailstock and a retractable tool block for load-unload clearance. Production information is given in the photo caption.

If tooling is planned to utilize the full capacity of the basic machine, you can also handle a wide range of dissimilar parts. M-D Blowers, Inc., uses the CRI-DAN B to machine and thread four sizes of pipe flanges (times range from 3.5 to 5.5 minutes f.t.f.); to thread shaft ends on seven sizes of SAE 4140 steel rotor shafts and ductile iron rotor shaft assemblies similar to those shown below (lengths from 16.2" to 28.6"—times from .45 to .7 minutes f.t.f.); and to machine and thread a number of other parts. Time reductions alone averaged 70% on all parts handled in the first month of operation—further savings are expected as more experience is gained.

CRI-DAN B Automatic Threading Lathes can be used to machine and thread standard and problem parts. You can expect time reductions of 30-80%. Other benefits include fewer operations, lower tool costs, automatic cycle efficiency, and . . . no compromise on quality.

For information on Cri-Dan, circle No. 762.

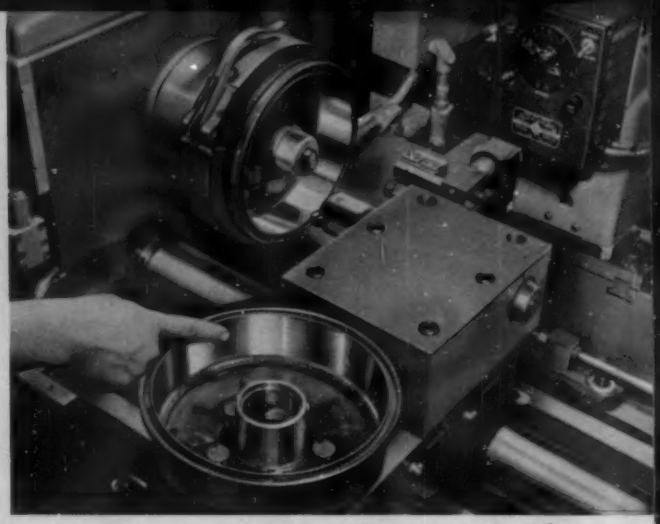


INEXPENSIVE SETUP DOES TWO JOBS IN ONE CHUCKING

No. 12 lathe machines and Superfinishes in one automatic operation

This "two-in-one" setup on the versatile Gisholt MASTER-LINE No.12 Automatic Chucking Lathe may give you cost-cutting ideas for your work. Here, machining and Superfinishing is combined in a fast automatic cycle. Reduced handling and minimum equipment investment cuts costs. Accuracy is improved by completing work in one chucking.

The workpiece, a hub and brake drum assembly, is chucked through the small bore on an air-operated drawback fixture. A vibration dampener is clamped around the O.D. The I.D. is finish bored from the front carriage, which then tips toward the spindle centerline for tool relief before withdrawal. Next, a Gisholt Superfinishing Attachment—mounted on the rear independent slide—moves into position. The slide holds and the Superfinish stone feeds in to engage the bore. The I.D. is Superfinished from a *bored* surface to 25 micro-inches rms. Total f.t.f. time . . . only 1.5. minutes.



Cast iron hub and brake drum assembly is held in bore . . . finish bored and then Superfinished in fast, 1.5 minute f.t.f. automatic cycle. This kind of setup has wide application since it can be used for flat, tapered or cylindrical I.D. and O.D. surfaces.

Low-cost setup combines operations . . . saves time and work-handling . . . improves accuracy. Product is also improved because Superfinish exposes true base metal and increases braking area by removing jagged peaks left by machining. Smoother finish assures longer service life for mating brake shoes.

For more information on No. 12's, circle No. 763.

RING GEAR PRODUCTION PROBLEMS SOLVED THROUGH SPECIAL TOOLING

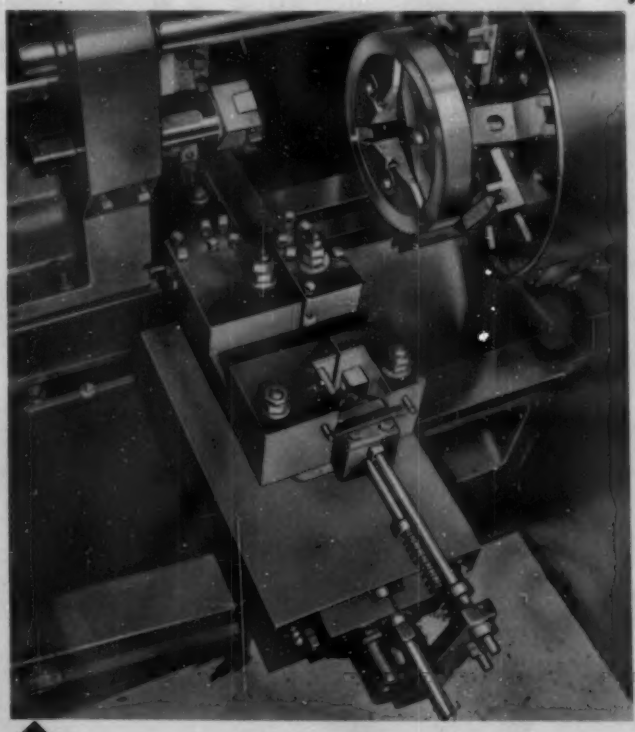
Alignment Concentricity and Fine Finish Simplified by Simplimatic Automatic Lathe

Maybe there's an idea for you in the way this manufacturer solved tough tooling problems with the right kind of setup.

The part, a steel final drive gear forging, had to have both front and rear faces perpendicular to the bore. Distortion through chucking pressures had to be absolute minimum. Location had to be accurate against dead stops, yet the back face had to be machined. No tool tracks could be left on front and back faces.

Every problem is licked through this smart tooling on a Gisholt Simplimatic: to equalize chucking pressures, avoid distortion and simplify alignment, swivel-type pie-shaped jaws chuck the work in the previously machined I.D. Maximum rigidity is assured through twin overhead pilot bars on a special boring head on the center slide. Clearance for straddle-facing and chamfering operations is provided by swinging jacks on the chuck face, which permit accurate location and swing out of the way. Tool tracks are eliminated by a special wedge-type tool relief arrangement on the rear slide. To bring the facing tools together, the wedge is engaged during the cut—then withdrawn to let the tool blocks spring apart for tool relief.

Floor-to-floor time? The job is completed in just 2.8 min.



Close-up of workpiece and tooling. Note wedge-type tool relief arrangement in rear slide.

Smart tooling plus the versatility of the Simplimatic eliminated many special problems in machining this final drive gear forging.

For information on Simplimatics, circle No. 764.

AR SAVES 60% ON SMALL PARTS FOR CULLIGAN, INC.

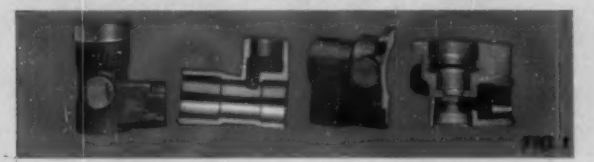
Automatic cycle, combined operations speed machining of softener components

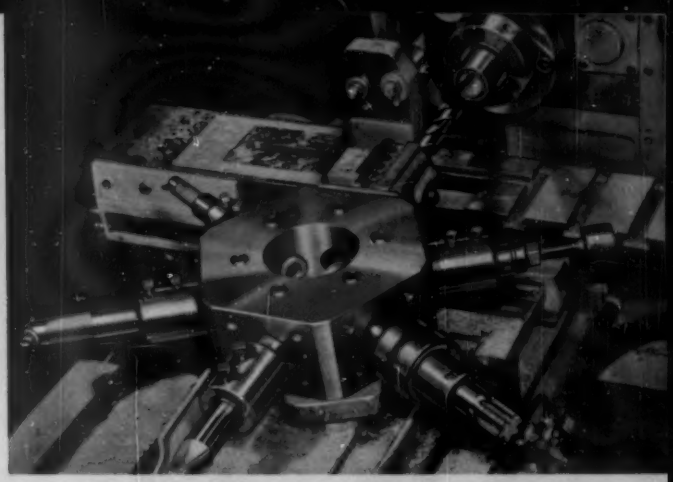
An *automatic* turret lathe, capable of handling both *bar* and *chucking* work, that changes over in an hour or less, may be what *you* need to cut costs in your shop. Culligan, Inc., Northbrook, Ill., took advantage of these features as soon as the Gisholt MASTERLINE AR (Automatic Ram) Turret Lathe became available. They installed two machines to handle a large variety of small water-conditioning equipment parts, produced in lots of 150 to 3,000 pieces.

One machine has an octagon turret and a 2-jaw automatic indexing chuck. All internal and external machining on four sizes of cast brass valve bodies is completed *automatically*, in *one* chucking. F.t.f. times range from 1.8 minutes (Fig. 1—left) to 2.2 minutes for complex parts (Fig. 1—right).

The same operator handles the second machine . . . a 5 AR, used for both bar and chucking work. Parts like the bronze flow control body casting (Fig. 2—left) are held in a 3-jaw combination chuck, machined and threaded in only 1.5 minutes f.t.f.

When arranged to produce a 2.411″ O.D. plunger ring (Fig. 2—right) from bronze bar stock, the entire cycle is automatic through cut-off and cycle repeat.



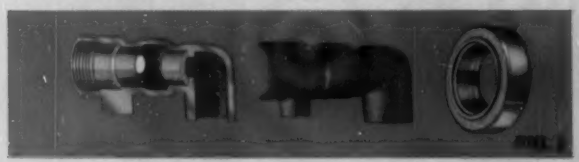


Plunger rings are machined from bronze bar stock with this setup. Automatic cycle includes collet open, feed stock to length, collet close, machine and thread I.D. from hex turret, face, form O.D. and cut-off from front of cross slide, and cycle repeat.

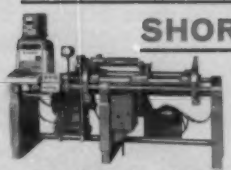
After the first two years of operating 16 hours a day, 5 days a week, Culligan, Inc. has obtained an average saving of 60% on all parts handled. Because the AR is simply an *automatic* ram type turret lathe, standard and special tooling that was a part of previous methods could be used on the new AR Turret Lathes. Other benefits included reduced handling, improved accuracy, quality and tool life, more consistent production rates and more efficient utilization of manpower.

AR Turret Lathe combines turret lathe versatility with automatic cycle . . . saves 60% on variety of standard and complex parts. One hour changeover for bar and chucking work offers cost advantages for large and small manufacturers.

For more information on AR's, circle No. 765.



LINCOLN ELECTRIC SIMPLIFIES SHORT-RUN BALANCING



Adjustable cradle handles over 83 different parts

The Lincoln Electric Co., Cleveland, Ohio, is a leading manufacturer of arc welding machines, electrodes and supplies, special electrical machinery and ac motors. At present, they offer five types of dc motor-generator welders requiring over 83 different armature and rotor assemblies. Lots range from 5 to 100, weights from 58 to 451 lbs. Their problem . . . how to accurately balance and correct these parts in two planes, at low cost . . . with minimum investment in new equipment.

The answer . . . a Gisholt MASTERLINE 3S Balancer with an extended bed. The 3S permitted balancing at operating speeds and offered capacity, quick setup and ease of calibration to show unbalance in terms of the correction method actually used. This last item was especially important to them because parts are corrected by soldering, welding, or addition of washers . . . or *combinations* of any two methods. Extra handling was eliminated too, because work is corrected and inspected before it leaves the machine.

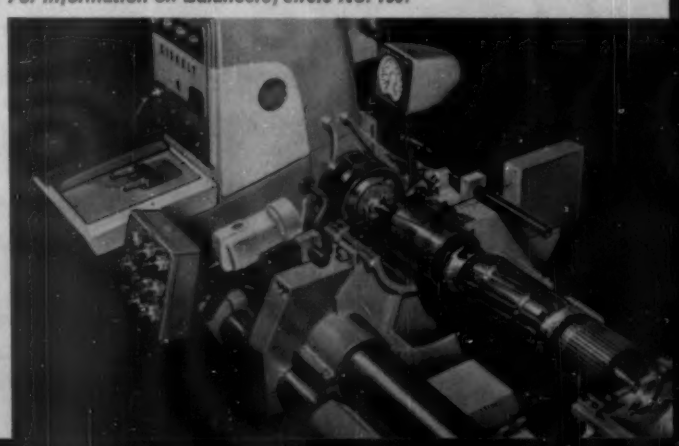
Motor generators are belt-driven over angularly graduated pulley at left using keyed sleeve bushing to connect. Here, half bearings are used. Parts with anti-friction bearings can also be supported in the fixture.

Idle time is at a minimum. A cradle fixture quickly adjusts for various lengths. A belt-driven, angularly graduated pulley connects to the work with keyed bushings for each size. Work can be rotated at any speed from 900 to 3600 rpm. Four main speed adjustment settings are pre-set and obtained through a selector switch.

Time to locate and measure unbalance in both planes ranges from 1 minute to 1.50 minutes. Correction time varies depending on the part and method used.

Versatile setup cuts time to minimum . . . assures complete accuracy . . . eliminates guesswork. One operator locates, measures, corrects and inspects for balance in both planes on one machine. Capacity and flexibility of 3S Balancer make it ideal for short- or long-run operations.

For information on Balancers, circle No. 766.



SUPERFINISH INCREASES SLITTING SAW LIFE FOR BROWN & SHARPE

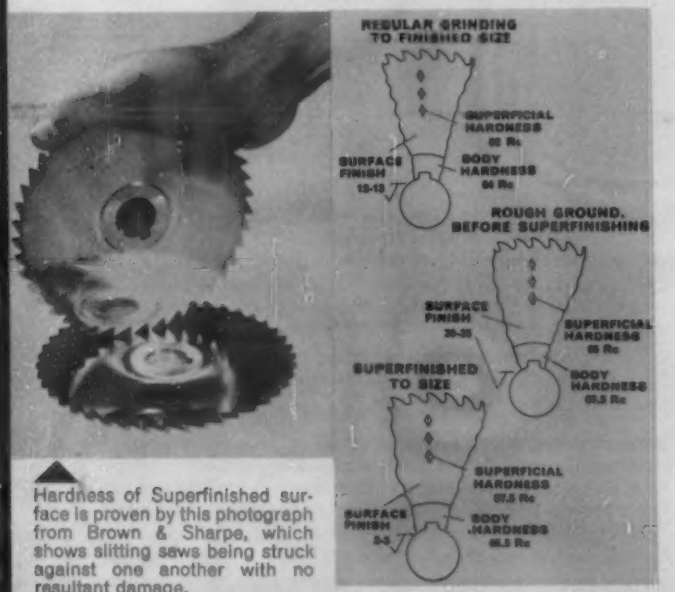
Gisholt "Productivity Team" approach pays off . . . produces a "Sawperior" product

Mr. Colin Sharp, Director, Research & Development Lab., Cutting Tool Division, Brown & Sharpe Mfg. Co., clearly stated the benefits of full cooperation between customer and supplier in a current metalworking publication.

He said, "About two years ago, we were exploring the possibilities of new, high-speed steels and heat treatment for saws, when a Sales Engineer from the Gisholt Machine Company called on us to discuss its Superfinishing process. This was a timely visit, and his claims for smooth, hard surfaces, free from grinding marks and softness sounded promising. It wasn't long after this that we had samples of Superfinished saws for testing and later purchased a machine for production."

The machine, a MASTERLINE Model 81 Vertical Superfinisher is used on 18 sizes of slitting saws from 2½" to 6" diameter. Formerly Brown & Sharpe ground to a 12-13 micro-inch surface. Now, they grind to 30-35 micro-inches, leaving .001" to .0015" stock per side. Superfinish then removes the outer "skin" that has been softened by grinding heat and exposes the true base metal so that hardness is uniform, across the entire saw face. A 2-3 micro-inch rms surface is produced in 30 to 45 seconds f.t.f. depending on part size.

Saws are held in a special fixture on a magnetic chuck to minimize distortion. Dial indicators are used to speed setups because the Superfinish quill supporting head and special swivel wheel holder must adjust to match the concavity of the saw. Superfinishing wheel and work spindle rotate in opposite directions to provide surface speed needed for best results.



Hardness of Superfinished surface is proven by this photograph from Brown & Sharpe, which shows slitting saws being struck against one another with no resultant damage.

Superfinish plus new saw geometry provides these advantages . . . and again, we quote Brown & Sharpe: (1) "Superfinished sides permit less concavity or side clearance providing a stronger saw section and a stiffer, more accurate saw; (2) . . . without noticeable scratches on the sides there is less tendency for cracks to develop; (3) . . . smooth finish resists scratching, resists corrosive action of coolants and rust . . . even though left for a considerable time in a humid atmosphere; (4) . . . new saw geometry and Superfinished sides give up to *four* times as much slitting production between sharpenings and smoother finishes . . . prevents chips from seizing and galling, requires less power and allows heavier cuts without strain or chatter."

Acquaint your Gisholt Representative with your new projects. He will turn them over to the Gisholt "Productivity Team"... experts in the fields of machining, threading, Superfinishing and balancing. You can be sure that our combined efforts will help you "do it for less".

For information on Superfinish, circle No. 767.

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The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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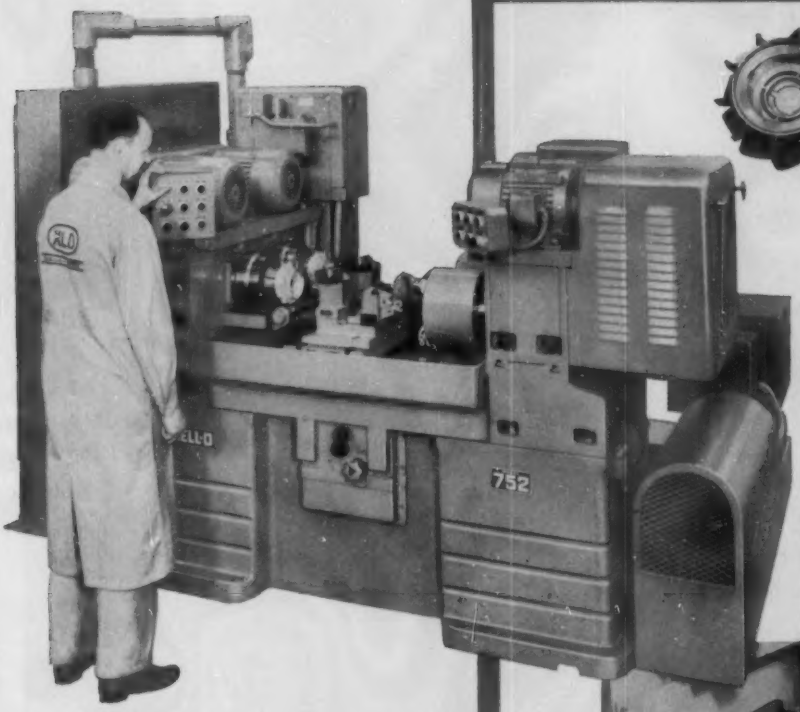
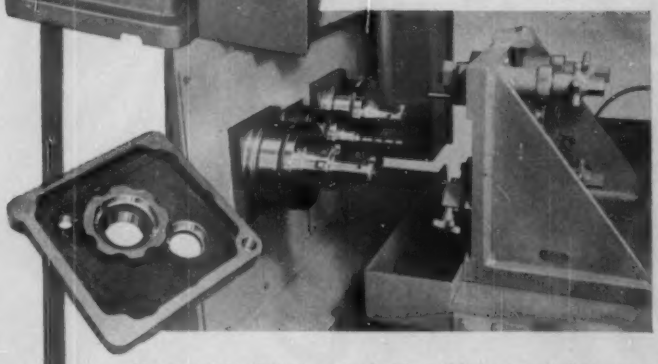


Double-end Model 752 (shown at left) finish-machines both sides of this torque converter stator in one cycle at a rate of 140 per hour. Standard tooling, spindles, and other components permit fast change-over from this job's boring, turning, facing, grooving and chamfering operations to any required single or multiple functions.



Close center-distances are held on this transmission pump cover, one of three different parts finished on a single-end Model 751 Precision Bore. Cross slide indexes during each cycle, and a common spindle bores the dowel holes. One or more Heavy Duty or Ultra-Precision Spindles can be used in place of the three Ex-Cell-O Square Body Spindles shown.

Modern Ex-Cell-Os represent over 30 years of specialization in Precision Boring Machines. Your Ex-Cell-O Representative has data on a wide variety of standard, special and building-block types to quickly provide optimum equipment utilization in your plant. Call him soon, or write direct for details.

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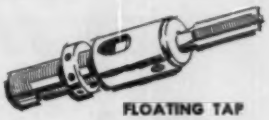
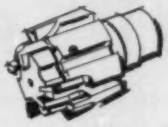
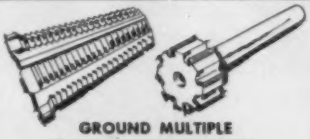


FLOATING TAP DRIVERS

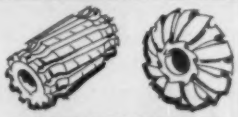
INSERTED BLADE FACE MILLS



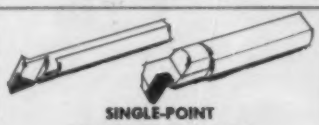
MULTIPLE DIAMETER BORING CUTTERS



GROUND MULTIPLE THREAD MILLING CUTTERS

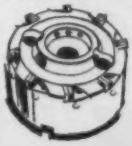


GROUND AND UNGROUND FORM-RELIEVED CUTTERS

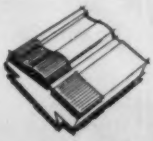


SINGLE-POINT CARBIDE TIPPED TOOLS

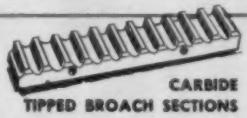
MULTIPLE STEP BORE REAMERS



CARBIDE TIPPED CYLINDER BORING CUTTERS



DOVETAIL FORM TOOLS



CARBIDE TIPPED BROACH SECTIONS

INVOLUTE SPLINE SHELL TYPE BROACHES

Every standard and special tool is of but one quality—the finest available. Since 1921, Continental has specialized in cost-saving cutting tools (just a few of which are shown at left), producing design innovations in hardened, high-speed tool steel, carbide and special-alloy cutting materials.

Available in the types and sizes required to do the *complete* job from rough to finish, Continental Cutting Tools are job-tested in the toughest proving ground—Ex-Cell-O's own machine tool and precision parts production lines. As a result, they come to you ready to increase the output of even your best machines!

Continental engineers will be glad to work with you in selecting the correct CTW Cutting Tool for long life and maximum performance. See your local Ex-Cell-O Representative, or write direct to Continental Tool Works Division for full details. In Canada, contact your local Ex-Cell-O Sales Associates Representative or write direct to Colonial Tool Co., Ltd., Windsor.

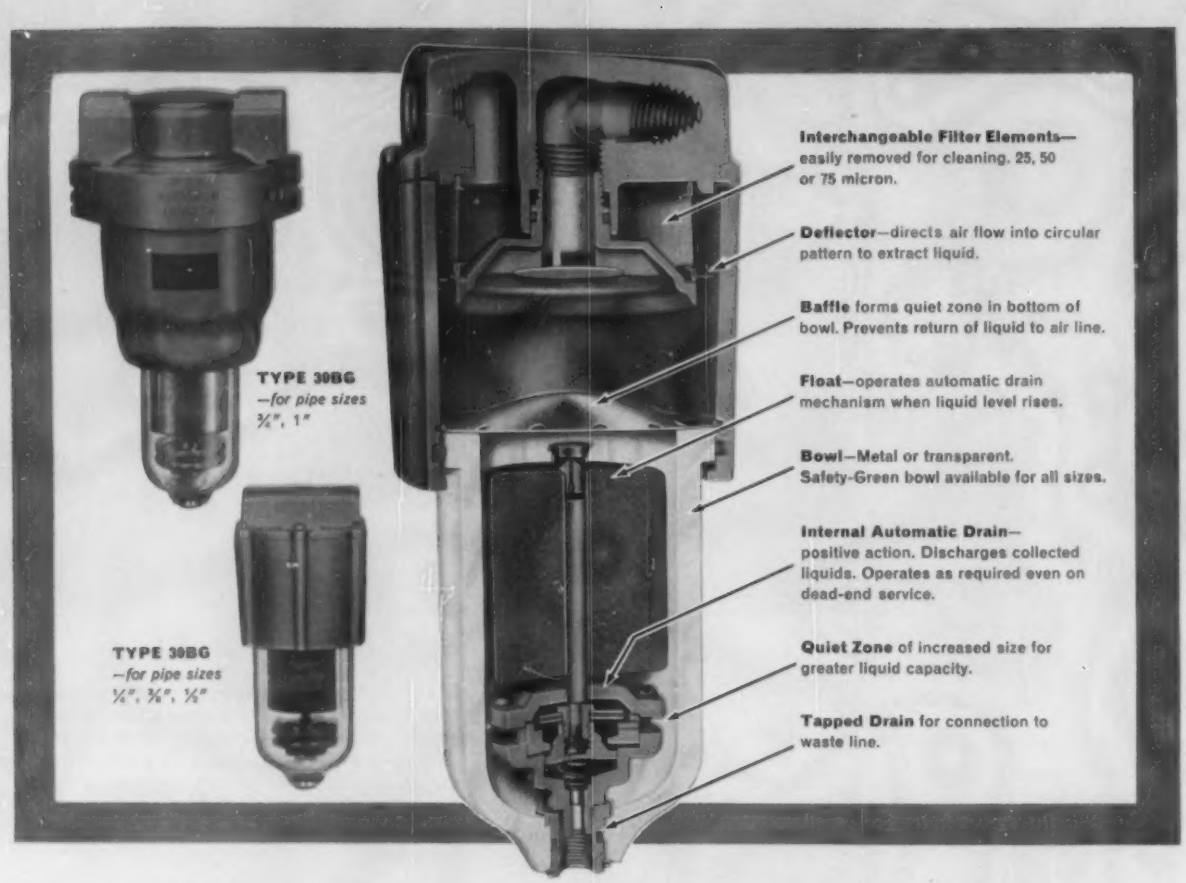
Continental **TOOL WORKS**

DIVISION OF

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

Use Reader Service Card, CIRCLE 19


TYPE 30BG
—for pipe sizes
¾", 1"
TYPE 30BG
—for pipe sizes
¼", ⅜", ½"
Interchangeable Filter Elements—easily removed for cleaning. 25, 50 or 75 micron.
Deflector—directs air flow into circular pattern to extract liquid.
Baffle forms quiet zone in bottom of bowl. Prevents return of liquid to air line.
Float—operates automatic drain mechanism when liquid level rises.
Bowl—Metal or transparent. Safety-Green bowl available for all sizes.
Internal Automatic Drain—positive action. Discharges collected liquids. Operates as required even on dead-end service.
Quiet Zone of increased size for greater liquid capacity.
Tapped Drain for connection to waste line.

Norgren Automatic-Drain Compressed-Air-Line Filters provide FULL-TIME protection

The purpose of a compressed-air-line filter is to remove liquids and solids from the air-stream so that they cannot clog, corrode or damage air-powered equipment. Your equipment needs this protection *full-time.*

Manual drain filters are often neglected . . . are not drained as often as they should be. When excess liquid collects in the bowl these filters no longer do the job. Liquid in the air-stream passes right on through to your air tools, cylinders and other air-operated equipment.

This cannot happen with Norgren Automatic-Drain Filters. They empty themselves as often as required . . . never get too full. Operation is determined entirely by the need for draining; and not, as with some makes, by changes in air pressure. Although an automatic-drain filter costs more than a manual drain filter, Norgren Automatic-Drain filters protect your air-powered equipment *full-time* day and night, year-in-year-out. They prevent costly wear and damage to your equipment and eliminate man-hour costs for manual draining.

Order Norgren Automatic-Drain Filters from your nearby Norgren Representative, listed in the telephone directory—or write factory for catalog.

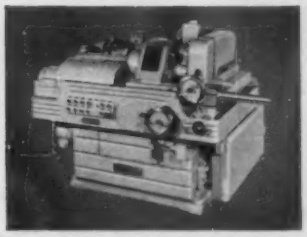
FOUNDED IN 1925

C. A. NORGREN CO.

3447 SOUTH ELATI STREET, ENGLEWOOD, COLORADO

THREAD GRINDING COSTS TOO HIGH?

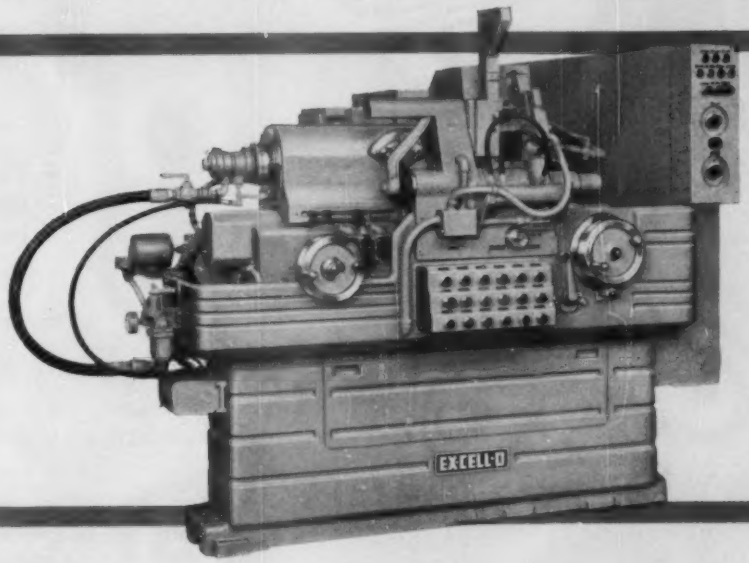
Here's How a Modern Ex-Cell-O can Increase Production and Lower Your Labor Costs



1939—Style 39 Ex-Cell-O Internal Thread Grinder, then the fastest of its kind, produced 17 automotive steering gear ball races per hour. It had power wheel dresser, automatic dresser compensation and automatic wheel feed.

1946—The part's the same, but the manufacturer has turned to a postwar Ex-Cell-O Style 39-A Precision Thread Grinder with fully automatic grinding cycle, including automatic wheel dressing at predetermined intervals. Operator simply loaded the part, reset the size handwheel and pressed the start button. Production increased to 24 parts per hour.

1960—Modern Style 39-A, today produces the same basic part but now at a rate of nearly 60 parts per hour. This powerful, versatile machine has a high-speed workhead, high-frequency Bryant Grinding Spindle, automatic loading, unloading and cycling. It requires only the part-time attention of one unskilled operator.



TOMORROW—Will you have a similar long-run part, or perhaps pinions, worms, taps, thread gages, lead screws, missile components or other special parts that cannot be rough- or finish-ground economically on your present equipment?

Your local Ex-Cell-O Representative can show you how modern Ex-Cell-O Precision Thread Grinders can substantially reduce the cost of producing a wide variety of your large and small threaded parts. Call him today, or write direct for details on the complete line of Ex-Cell-O Internal, External and Universal Thread Grinders for every toolroom and production job.

60-35

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

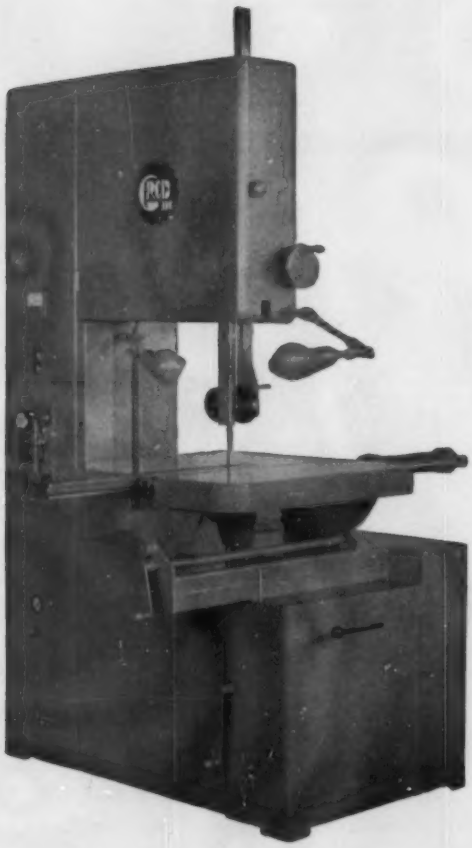
EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

GROB SPELLS THE DIFFERENCE IN BAND SAW MACHINES

The new GROB 24" universal band saw has all the famous GROB features:

Quality • Efficiency • Durability • Strength
Utility • Low Maintenance • Reasonable Cost



- Speeds infinite from 35-12000 FPM covers both cold and hot sawing
- Variable drive 3-speed transmission with precision rolled gears and splines transmits 15 HP
- Hydraulic table feed

See the difference demonstrated in our dealers' showrooms

or

Write GROB INC. for complete specifications

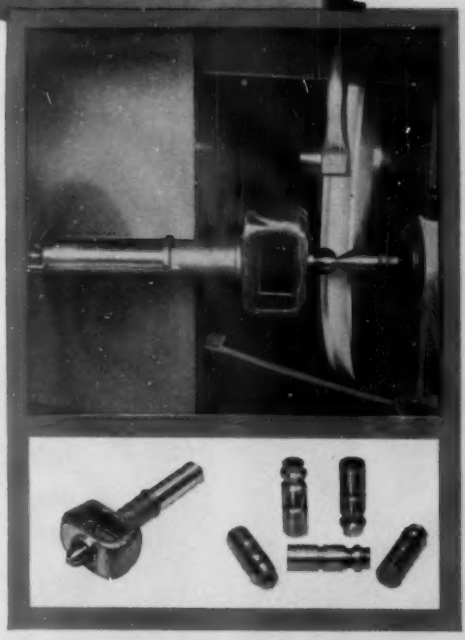
GROB also manufactures a complete line of:

BUTT WELDERS
FILING MACHINES
GEAR ROLLING MACHINES

GROB INC

GRAFTON, WISCONSIN

NOW—An Automatic Form and Groove Grinder . . . designed for tomorrow's production requirements!



WORKPIECES—Standard Ex-Cell-O Model 973 takes parts up to 24″ long. Can be equipped for parts with 36″ centers. Workhead adjustable for angular settings.

OPERATIONS—Precision-built for rough, semifinished or finished production grinding.

CONTOURS—Grinds straight, angular and radius grooves, and a variety of forms. Grinds multiple grooves when fitted with two or more wheels.

CYCLING—Fully automatic cycling, including opening and closing hood. Rapid wheel slide advance and return for maximum productivity.

SIZE CONTROL—Automatic wheel dressing after each cycle or any number of cycles. Automatic wheel size compensation after each dressing. (Handwheel graduated to .0002″ for manual setting.)

DRESSERS—Designed for use with all standard Ex-Cell-O Diamond Dressers, or any special rotary diamond-set wheel dressers.

ACCESSORIES—Model 973 is a complete, versatile machine with extensive automatic features. However, it is designed to be easily equipped with automatic work loading and unloading devices, air operated chuck and tailstock and other accessories to meet your special requirements.

DATA AVAILABLE—Contact your local Ex-Cell-O Representative, or write direct for descriptive literature and engineering data.

61—25M

EX-CELL-O FOR PRECISION

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Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

for drilling . . .

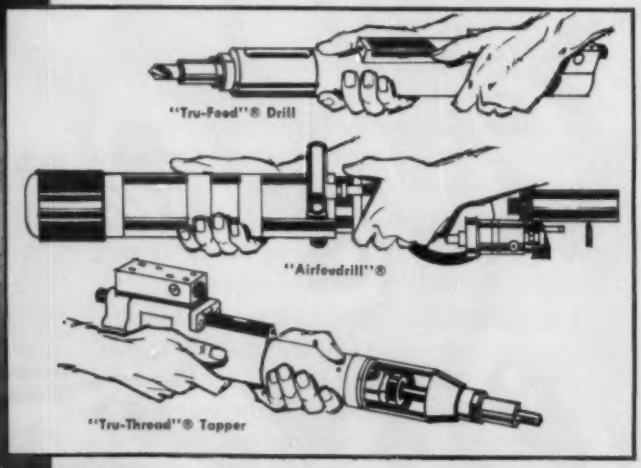
bring precision to these hands with the right air tools

For drilling one hole or hundreds, Gardner-Denver offers the right tools to get precision production from expensive hands.

Attachments for all types, all sizes of drills provide hundreds of uses for the basic air motor—assuring complete versatility and interchangeability.

Look at "Airfeedrill" units, for example. Mount 2, 20 or more for automatic drilling. Or just use one as either a stationary or portable drill.

For details on fast, precision drilling, see your Gardner-Denver air tools specialist, or write for bulletins.



GARDNER-DENVER Since 1859

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

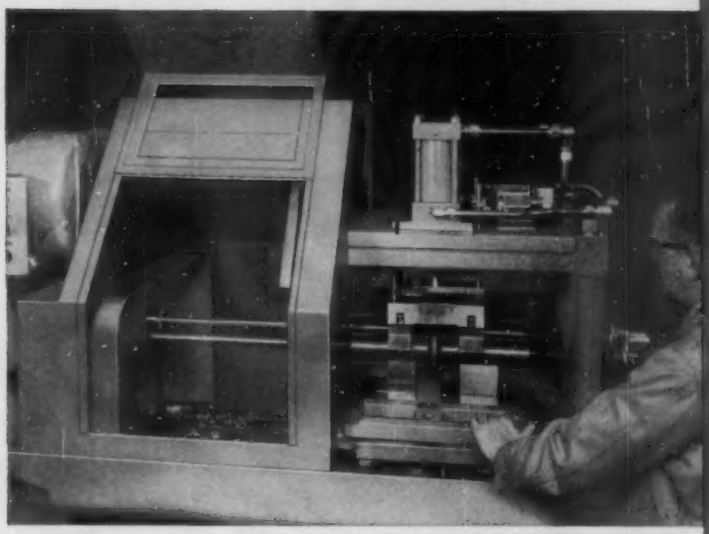
Gardner-Denver Company, Quincy, Illinois—Offices in principal U.S., Canadian and Mexican cities. In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ontario. International: Gardner-Denver International Division, 233 Broadway, New York 7, N.Y.

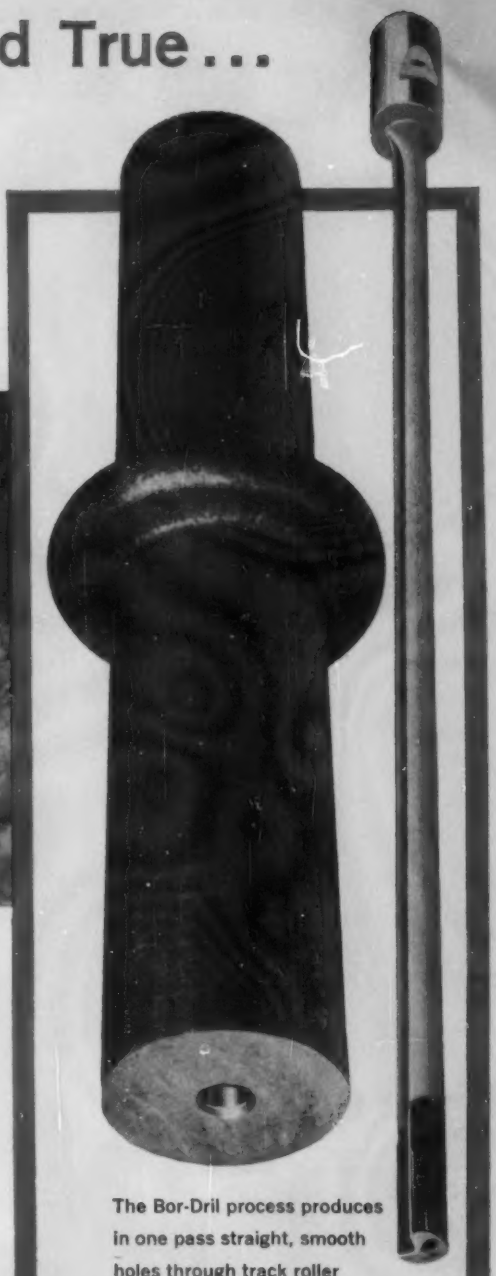
International Offices: Buenos Aires, Argentina; Artarmon, N.S.W. Australia; Brussels, Belgium; Rio de Janeiro, Brazil; Santiago, Chile; Barranquilla, Colombia; Lima, Peru; Ndola, N. Rhodesia; Salisbury, S. Rhodesia; Johannesburg, Transvaal.

Deep Holes... Fast and True... with Ex-Cell-O

BOR-DRIL

Process





The Bor-Dril process produces in one pass straight, smooth holes through track roller shafts 22½" long and weighing about 75 pounds each. Production is 20 pieces per hour on the two-station machine.

Drilling 11/16" diameter holes the full length of 22½"-long forgings posed a tough problem for production engineers who need the economy of volume output, the time-savings of one-step operations, and the performance of precision equipment. But they found the answer in Bor-Dril, Ex-Cell-O's process for gun-type drilling with standard production boring machines.

Measured in terms of production efficiency, the result is 20 pieces per hour, from an Ex-Cell-O Model 752 Precision Boring Machine set up for Bor-Drilling. Secondary operations are eliminated.

Bor-Dril can be applied easily and economically wherever you have long, small-diameter holes to produce to precision tolerances. See your Ex-Cell-O Representative, or submit your requirements direct to Ex-Cell-O for prompt analysis and cost estimate.

61-78M

EX-CELL-O FOR PRECISION

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Machinery Division

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

Stop stripped threads and loose fasteners with IMPACTOOLS THAT SHUT OFF AUTOMATICALLY!

Ingersoll-Rand Impactools prevent stripped threads and loose fasteners yet insure proper tightness with automatic shut-off.

When using these advanced design tools the operator no longer must judge when the nut or bolt is tight. The tools operate at full power and speed right up to the point of automatic shut-off. And—if by accident the operator should again pull the trigger—the tool will immediately shut itself off without damage to the fastener. This feature not only eliminates loose, stripped or over-stressed nuts and bolts, but also saves time, reduces air consumption and increases tool life!

If your operations involve nut or bolt running, you can do it faster and safer with Ingersoll-Rand Impactools that shut off automatically. Ask your nearby Ingersoll-Rand AIRengineer for a demonstration or write for information.

225A-8

Ingersoll-Rand
11 Broadway, New York 4, N. Y.
Planned Annual Retooling increases output per man

Truck brake assembly is fast, easy and safe with Ingersoll-Rand automatic shut-off Impactools. No broken bolts, stripped threads, wasted time.

Thomas H. West
President
DRAPER CORPORATION
Hopedale, Mass.

"THE MACHINE TOOL GAP...

a danger to the nation...and to industry"

"We've heard a lot about the missile gap. Some agree it exists — some disagree. But it certainly appears there *is* a 'machine tool gap'.

"Neglecting to replace obsolete production equipment is a hazard we can no longer afford. It is dangerous to the nation because it threatens our very survival in the cold war. It handicaps the individual manufacturer because a strong competitive position cannot be maintained without the most efficient equipment available.

"At DRAPER CORPORATION, our machine tool budget is planned to keep us well prepared to meet this constant challenge."

This statement reprinted courtesy of Draper Corporation

Brown & Sharpe

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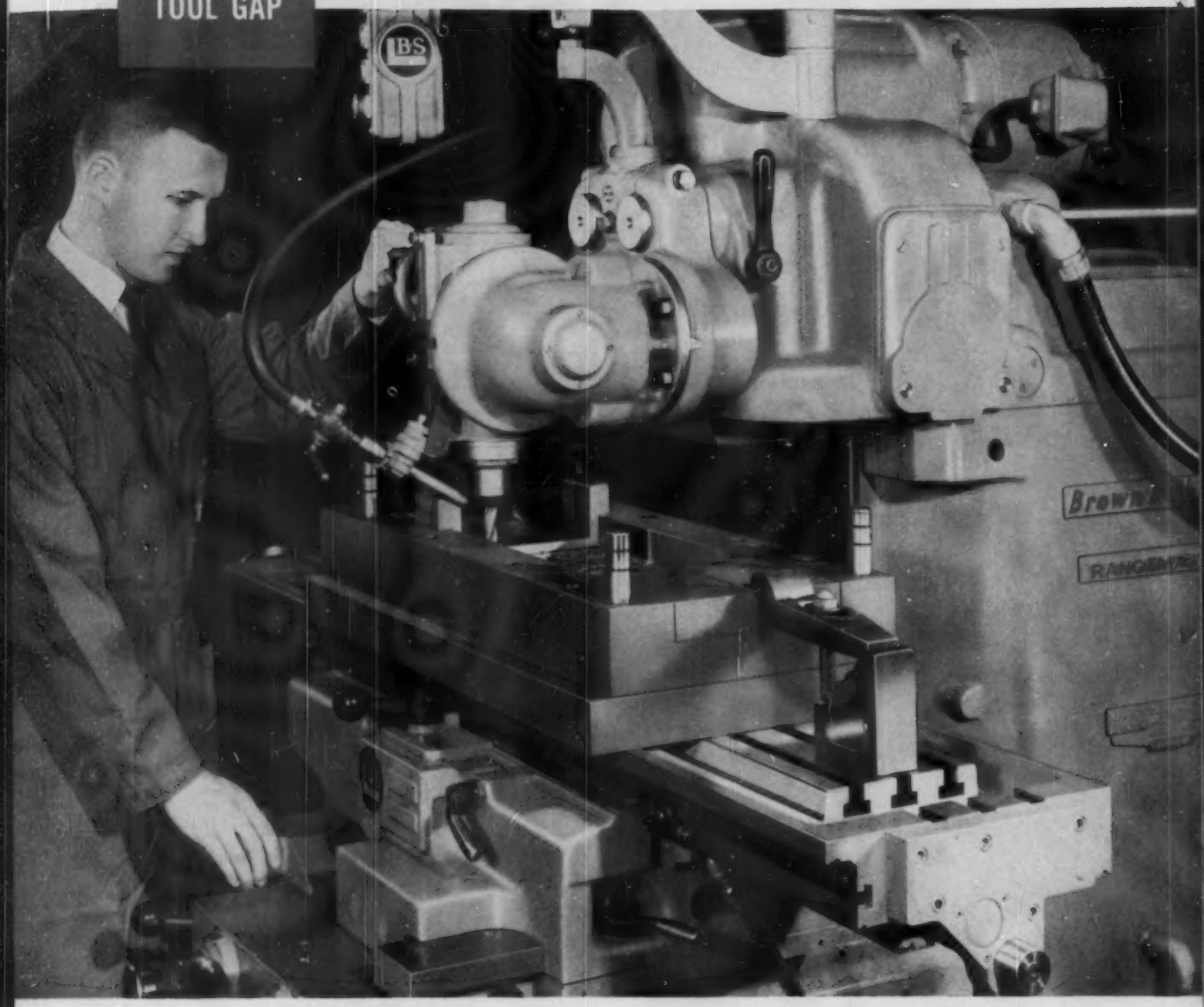
Close the MACHINE TOOL GAP

MODERNIZE MILLING AND MAKE MORE FOR LESS



New B&S RANGEMASTER® provides biggest work capacity in its class... saves extra cost of bigger machine

The new Brown & Sharpe RANGEMASTER has the largest working area ever offered in a No. 2 size milling machine table. You can mill all around pieces that would normally require a No. 3 size or larger machine, like the big plastic mold shown, without changing the set-up. Table travel up to 34" * is available, and transverse feed up to 12".

You can mill deep down inside, also. The vertical spindle can be centered up to 25" away from the face of the column. It has a compound swivel and 3½" axial feed. You save on set-up time, and on tooling costs, since both spindles have the same standard taper.

With the many new B&S DYNAMASTER design features, the RANGEMASTER is now, more than ever, your best investment in a sliding head, "ram-type" milling machine — for toolroom, prototype, experimental, and maintenance jobs.

Ask for complete information on the No. 20 RANGEMASTER, 3 HP Universal or Plain. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

*78 SQ. IN. MORE WORKING AREA. When specified, the RANGEMASTER can be furnished with table 60⅛" long and 34" table travel — plus completely automatic climb milling engaged during feed only. The standard table is 54⅛" long with 28" travel. The DYNAMASTER provides a wide range of feeds, and is also available with double the standard feed rate.

Brown & Sharpe PRECISION CENTER

Use Reader Service Card, CIRCLE 28

Close the MACHINE TOOL GAP

MODERNIZE GRINDING AND MAKE MORE FOR LESS

For "all around" sharpening at lower cost...
B&S No.10N and No.5 Cutter and Tool Grinding Machines

Both the No. 10N and the No. 5 Tool Grinders are 100% operative from any point in 360° of work area. This is just one of the many B&S design features that permit you to handle a bigger variety of sharpening jobs, with substantial time savings.

You get all the advantages of machines *designed by cutter specialists*. As a leading producer of cutting tools, Brown & Sharpe can fully anticipate your needs. Every feature required for the most intricate sharpening problems is available in machines and attachments. *You buy only what you need* for your operations.

Brown & Sharpe design provides wheel mounting at *both* ends of the spindle. A cutter bar attachment *eliminates critical table setting* for peripheral sharpening. Wheel spindles mounted on pre-loaded, permanently sealed ball-bearings assure consistent high precision and fine finish.

For full information, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

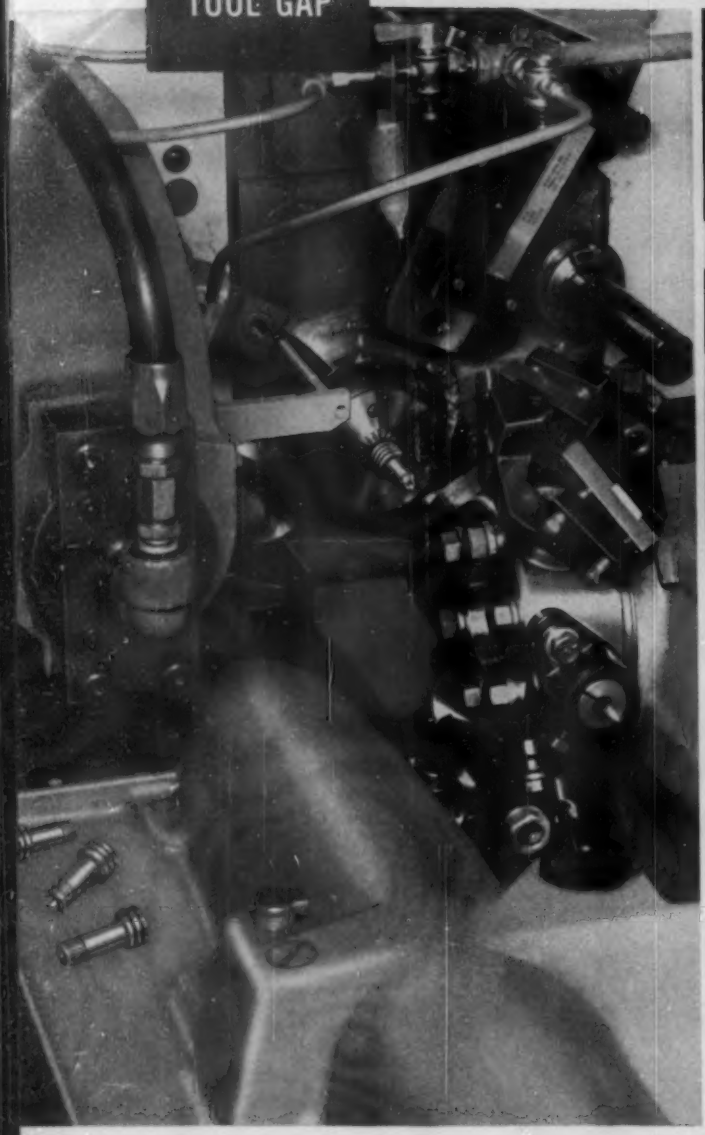
No. 10N (above), capacity 10" x 29", will handle all your sharpening jobs. With optional equipment, it can also be used for light external and internal cylindrical grinding and surface grinding. No. 5 has ample capacity, 6⅛" x 17½", for routine sharpening — takes less than 8 sq. ft. of floor space. Standard work head tapers fit all commonly used collets and adapters.

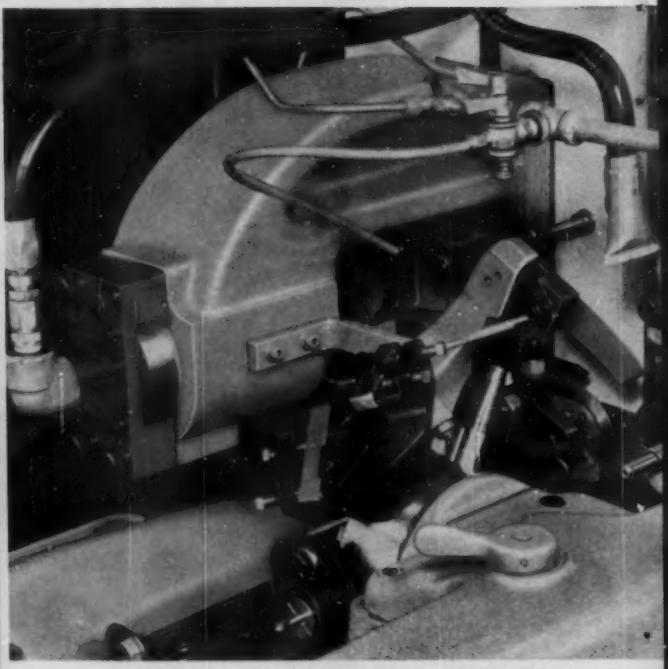
Brown & Sharpe PRECISION CENTER

Use Reader Service Card, CIRCLE 29

Close the MACHINE TOOL GAP

MODERNIZE SCREW MACHINING
AND MAKE MORE FOR LESS



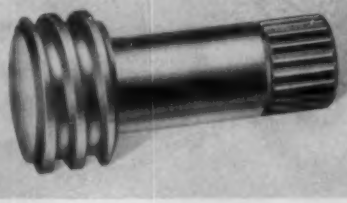


New B&S Broaching Attachment operates in "free" time while other machining proceeds at the spindle.

60% SAVING

With previous equipment		With B&S Automatic and Broaching Att.
45*	sec. per piece	16

*includes time for secondary operation which is now eliminated, for drilling and tapping on hand machine.



New B&S Broaching Attachment helps reduce cost 60% for part now produced complete on No. 2-¾" Automatic

The valve stem shown, made from ¾" brass rod, requires turning, drilling, forming, threading, tapping, and broaching. All machining is completed in one cycle on a B&S No. 2-¾" Automatic equipped with a Broaching Attachment. The extra cost of a secondary operation on a separate hand screw machine, formerly required for drilling and tapping, is now eliminated.

The new B&S Broaching Attachment permits a further saving. Broaching is "free", since the operation is performed automatically by the attachment while the next piece is being machined at the spindle. Production time, formerly 45 sec., is now 16 sec. per piece — a saving of 60% in production cost over the previous method.

The new design B&S Automatics offer *you* comparable savings. You get extra adaptability for combined operations. Parts that normally require secondary operations for unusual slotting, milling, drilling, or tapping, as well as broaching, can now be machined complete from the bar.

The B&S No. 2 Automatic is available in 3 sizes — ¾", 1¼", and 1½" spindle capacity. For complete information write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

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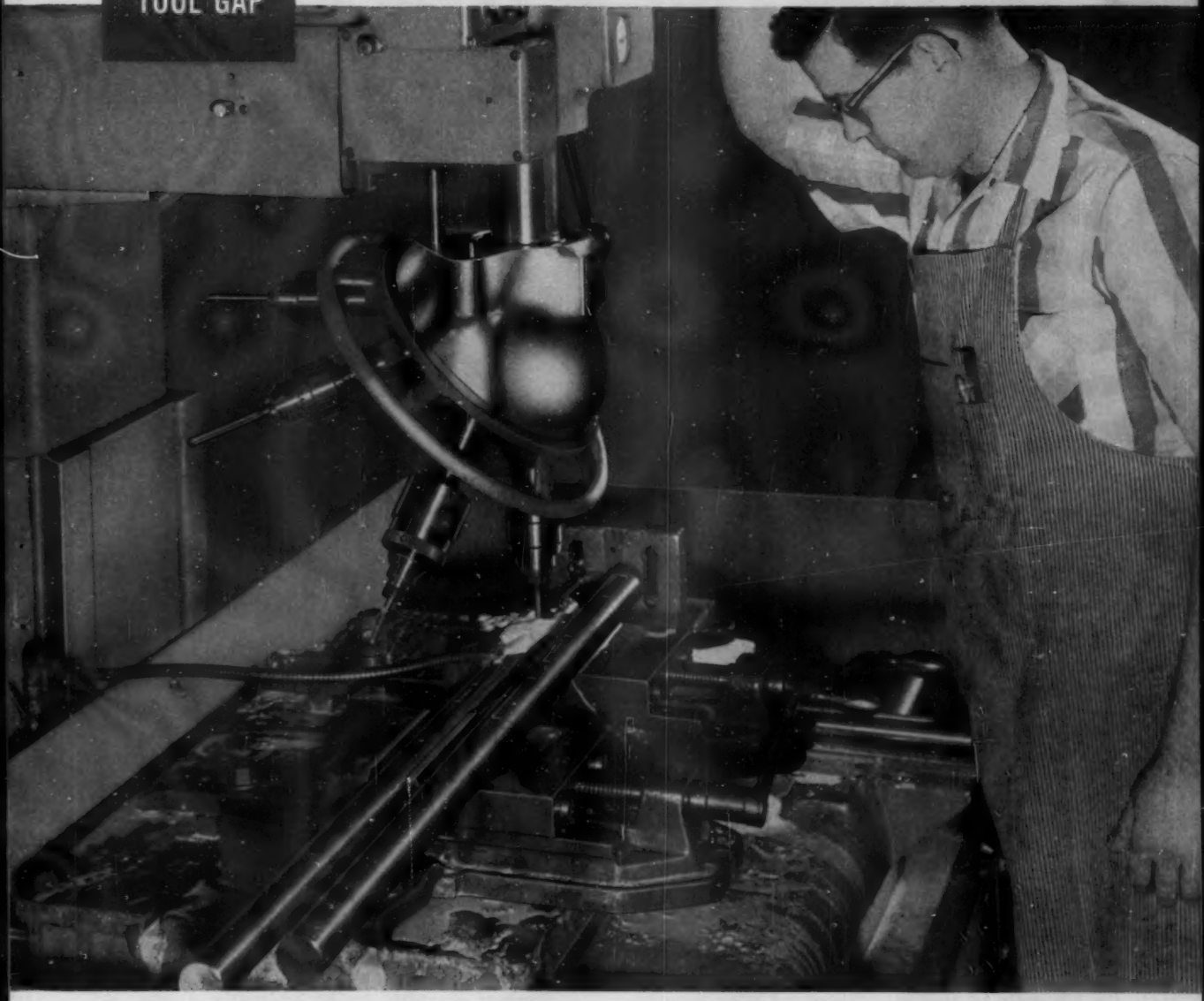
Close the MACHINE TOOL GAP

MODERNIZE DRILLING AND MAKE MORE FOR LESS



B&S Turret Drilling cuts time from 32 to 10 minutes for machining 11 holes in case-hardened shaft

Drilling and tapping 11 bottom holes in a 1½" dia. case-hardened steel shaft took 32 minutes as previously performed on a single spindle machine. Slow manual setting was required to meet the 0.003" locating tolerance specified for each hole. Changing tools for the various operations further increased production time and costs.

The same job is now performed on a Brown & Sharpe Model B Turret Drilling Machine, and requires only 10 minutes per shaft. The rectangular B&S Positioning Table used accurately locates the work for each successive hole. No fixtures are required. Two shafts, held in standard vises mounted on the table, are machined in each set-up.

The six tools in the turret are indexed successively into accurate alignment with the machine spindle. The operations are: (1) penetrate case with ½" carbide drill, (2) spot drill 5/16" dia. 3/32" deep, (3) flatten bottom of hole with end mill, (4) center drill, (5) drill 0.265" dia. 1 1/32" deep, (6) tap 5/16" x 18 to bottom.

B&S Turret Drilling permits multiple operations at a single station, with one set-up — accurate duplication of any hole pattern without expensive jigs. Find out how much it can save for you, in all types of production drilling and tapping. For complete information, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

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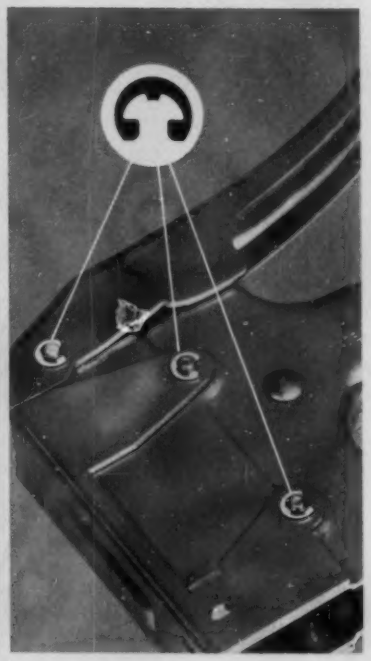
Here's how ARROW FASTENER Co. gets Truarc® Retaining Rings FREE!



U.S. PAT. NO. 2,937,812

Mechanized Ring-O-Mat® designed by Truarc Engineers doubles stapler production for saving of $2500/year

Arrow Fastener Co., Inc., Brooklyn, N. Y., uses three Truarc Series 5144 reinforced E-rings to secure components in its Model T-50 compression stapler. Originally, Arrow operators installed the rings by hand with conventional applicators and dispensers. Fast? Sure — but Truarc engineers suggested to the company how the job could be done even faster and more economically by mechanizing the entire ring assembly operation.

Working closely with the Arrow engineering and production staff, Truarc mechanization engineers designed the unique Ring-O-Mat shown above. The unit installs the three E-rings in a single operation, twice as fast as the former hand method. Savings with the equipment are $2500 a year — enough to pay for all the rings the company uses!

Here's how the Ring-O-Mat works. The Truarc rings are supplied in tape-wrapped Rol-Pak® cartridges which are loaded on vertical magazine rails at the center of the unit. To install the rings, the operator merely places the stapler in a nest at the front and pushes the control buttons . . . the Ring-O-Mat does the rest! Applicators connected to the air cylinders grasp the bottom ring in each stack and move forward, seating the rings in accurately located grooves pre-cut in pivot pins extending through the body of the stapler. When the rings are fully seated, the applicators are withdrawn automatically and the operation is completed. Simple, fast, fool-proof — a typical example of how Truarc retaining rings lend themselves to mechanized assembly. A good example also of how you get *more* than a fastener when you buy Truarc!

Interested in getting your retaining rings FREE?

Bulletin 459-13 describes a number of assembly techniques for mass-production ring installation. Write for a copy or see your Truarc representative.

WALDES KOHINOOR, INC.

47-16 Austel Place, Long Island City 1, New York

61-5

WALDES TRUARC® RETAINING RINGS

Use Reader Service Card, CIRCLE 32

Use Reader Service Card, CIRCLE 33

Checking centerless ground parts with Starrett No. 483 V-Anvil Micrometer.

Starrett® v-anvil micrometer spots centerless grinding errors

Starrett V-Anvil Micrometer No. 483 with 3-point contact spots out-of-roundness errors other mikes miss, warns centerless grinder operators to adjust the machine, saves making costly scrap. Also measures 3-fluted cutting tools — taps, milling cutters, reamers. (V-Anvil Micrometer No. 485 measures 5-fluted cutters.) Carbide-faced anvils and spindle guard its precision under abrasive conditions. SATIN CHROME finish resists rust and stains, makes it easy to read in any light. Your nearby Industrial Supply Distributor stocks a complete line of Starrett products — each the best of its type. He is your best source for prompt delivery, dependable service, quality products. Call him or write for complete catalog No. 27. The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

World's Greatest Toolmakers

No. 220 MUL-T-ANVIL MICROMETER used for measuring wall section of part with eccentric hole, distance from blind slot to edge, and flange thickness using "V" anvil.

UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel —the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.

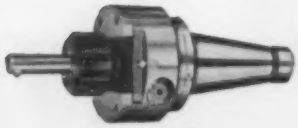
213

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck

Standard Collet Chuck

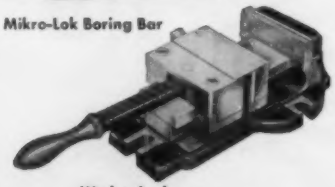
Mikro-Lok Boring Bar



Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing



Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 4, MICHIGAN

Use Reader Service Card, CIRCLE 33

Use Reader Service Card, CIRCLE 34

New—
CARMET'S 700 Series Cutting Grades and the fine art of making chips

Some people baby their carbide tools. They hold back a little on roughing cuts, because they've heard carbide is pretty brittle . . . and some of it is. Or they ease off on finishing cuts, because their tool may be too soft for long, fast passes . . . because it may wear or crater. And, some of it will.

But this is "paring-knife" machining, and it really isn't necessary. Not any more . . . not since Carmet introduced the 700 Series Steelcutting Grades. No paring knife made these chips . . . these were hogged out on a production basis by one of Carmet's new carbides . . . Grade CA-720.

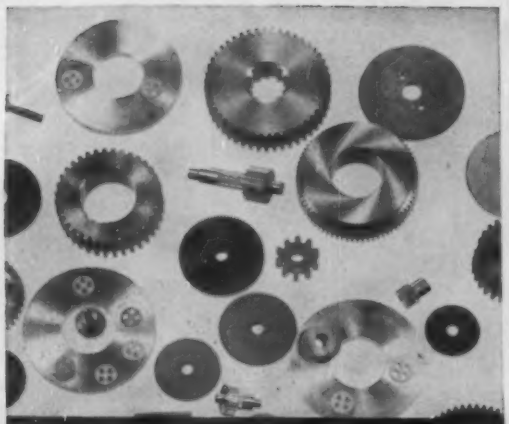
The job: rough facing railroad axle forgings in an automatic tracer lathe—210 sfm—.076" feed—1¼" width of cut. The result: over 1,000 cubic inches of steel removed in 5½ minutes, floor to floor, with plenty of red hot chips like these. And, 35 axles per tool against 25 pieces for the best competitive carbide tool . . . a tool carrying a higher price tag.

Carmet's 700 Series have the edge wear and crater resistance, *and* the ability to endure shock and heat, to breeze through jobs like this. They're doing just that all over the country . . . right now! Next time you're setting up a mean, tool-buster of a cut, let the 700 Series make chips and money for you, just once. Your Carmet Distributor has the local stock and all the information. Call him, or write:
Carmet Division, Allegheny Ludlum Steel Corporation, Ferndale, Detroit 20, Michigan. Dept. TE-9-3.

CARMET® AL

CEMENTED CARBIDE · DIVISION OF ALLEGHENY LUDLUM

3932

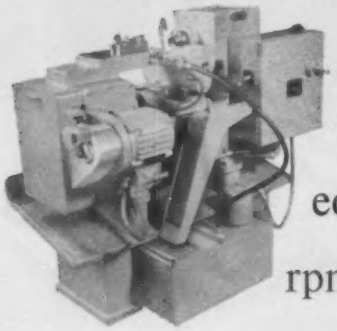


■Here is an opportunity to add powerful sales appeal to your product without increasing costs. As a result of recent Barber-Colman innovations in hobbing, it is economically feasible to put instru-

NEW

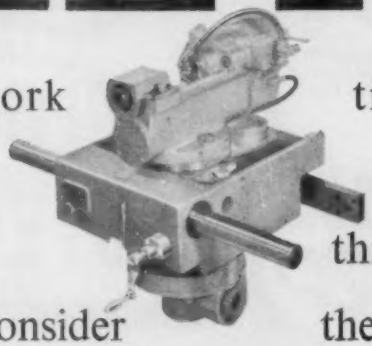
ment gear quality into any product. / The new method is production hobbing of fine-pitch spur gears of AGMA Precision Class 3 quality... quality which cannot be produced economically by any other method. It's the new No. 2½-4, a machine which Barber-Colman guarantees will index accurately within 20 seconds of arc. This means that in a 2" diameter gear, nonadjacent tooth-spacing error caused by machine indexing can be held within

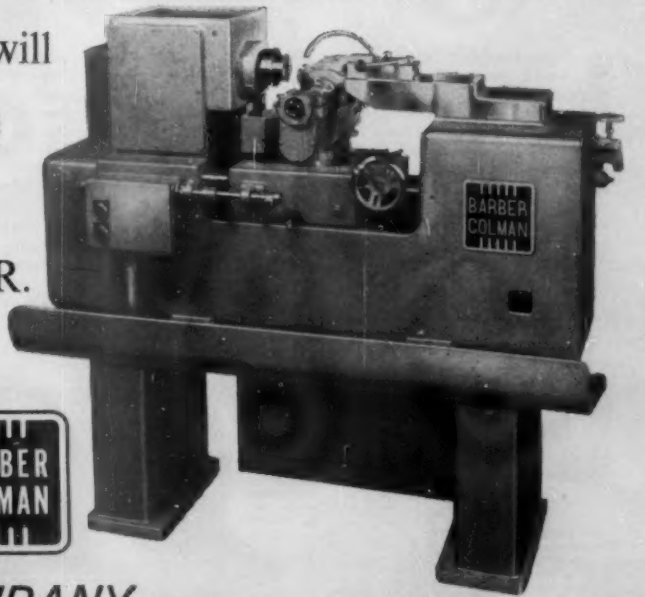
.0001". / This extraordinary precision has been combined with economy through machine simplicity. The position of the work spindle of the No. 2½-4 is fixed, increasing rigidity. Hob carriage is completely antifriction-equipped. Hob speed is infinitely variable to 1200 rpm. A stiff, direct-feed drive eliminates error in



METHOD

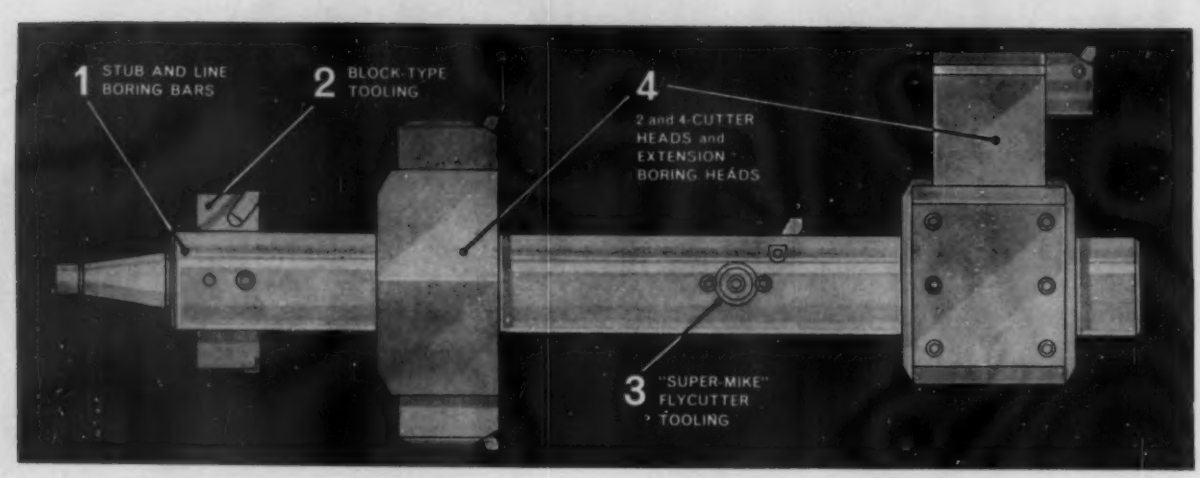
hob-to-work timing. These and other unique machine features are triggering important break-throughs in gear-cutting cost and quality. Consider the total impact of product improvement through precision gearing in your industry—of "cost-free," plus values your customers will recognize and buy. / See the No. 2½-4 hobbing your gear blanks in our TEST CENTER. Your Barber-Colman representative will make all the arrangements.





BARBER COLMAN

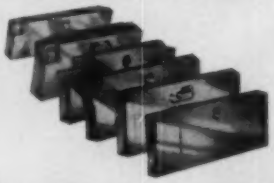
BARBER-COLMAN COMPANY 912 LOOMIS STREET, ROCKFORD, ILLINOIS


1 STUB AND LINE BORING BARS
2 BLOCK-TYPE TOOLING
4 2 and 4-CUTTER HEADS and EXTENSION BORING HEADS
3 "SUPER-MIKE" FLYCUTTER TOOLING

DAVIS ENGINEERED TOOLING SYSTEM

1 **Stub and line boring bars** are the key to the Davis Tooling System — the basic units for mounting all Davis tooling. By balancing type, size, combination and spacing of slots, a minimum number of bars provide maximum coverage of diameters and machining operations. Standard bars are available from 1¼" to 7" in diameter, up to 204" in length, specials from ¾" to 14" in diameter and to any length. Catalog D-520.

2 **Davis interchangeable block tooling** is available in six types from stock in a bore range from ¾" to 17". Tooling includes one- and two-cutter types with SHSS, TCT, or throwaway carbide insert cutters. In any given series, blocks are quickly interchangeable in the same bar without removing the bar from the machine. Bar inventory is reduced substantially. Accuracy is preset in the toolroom, eliminating costly cut-and-try methods. Catalog D-510A.



3 **"Super-Mike" adjustable flycutter tools** provide precision micrometer adjustment to .0001" for bores from 1¼" to 9" diameter. SHSS, TCT, and throw-away insert cutters are interchangeable for maximum tool flexibility. Square design cutter body provides maximum support under the cutting edge, yet requires a *smaller* opening in the bar, resulting in greater over-all tool rigidity. Available separately or in stub boring tool sets. Catalog D-520A.

4 **Multiple-cutter and extension boring heads.** Two- and four-cutter heads are available with "Super-Mike," continuous adjustment, and plain type cutters. A modest investment in bodies, spacers, and heads provides heavy boring capacity over a range from 7½" to 26".

Extension boring heads cover bores from 9½" to 50" in diameter. Modifications permit taper turning and boring, grooving, facing, and other operations. Catalog D-530.

"CF" continuous-feed heads — range ⅞" to 25".
Precize VBM and VTL tooling. All new super-accurate tools preset before machine mounting.
Stub boring tool sets — range from ⅞" to 18".
Special heads — Davis-engineered to fulfill any production requirement.

Building-block design provides maximum versatility with minimum tool investment

Are you making full use of the production capability built into your modern machine tools? You can with Davis standard bars, blocks, flycutters, and boring heads — the most productive, versatile, and economical tooling system available anywhere for general-purpose or production operations. Reports from large and small shops alike show that production increases of 25% to 50% are common when Davis tooling and engineering experience are put to work. For more information on the Davis Engineered Tooling System write for literature listed.

GIDDINGS & LEWIS

DAVIS DIVISION
Giddings & Lewis Machine Tool Company
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100 years of machine tool craftsmanship

D-61-1

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NEW YORK CHICAGO LOS ANGELES

The two drills shown illustrate the range of standard drill sizes and types available from W & B inventories.

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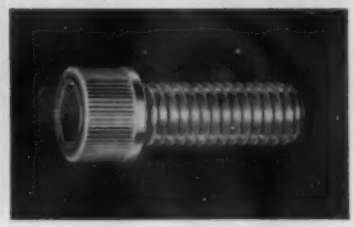
UNBRAKO pHd Hi-Life, today's only all-new socket screw. Increased bearing area, radiused thread root give up to 2⅓ times as much holding power, twice the fatigue strength of ordinary screws.

K 16 socket heads give you a bonus of 300% more fatigue life than regular socket screws; replace costly specials, provide design insurance in high fatigue applications.

Stainless UNBRAKOS meet your needs for corrosion-resistant fastening through a temperature range from −300° to 800°F. Other design considerations: low magnetic permeability; good appearance.



UNBRAKO KS 812 stainless socket screws offer 125,000 psi tensile—*certified;* help you increase strength of stainless assemblies without paying the price of specials. Identified by groove around socket.

Off the shelf...

an UNBRAKO socket head cap screw for every assembly need

Alloy or stainless . . . normal or critical application . . . there is an UNBRAKO socket head cap screw to meet almost any assembly need. Here is the selection that SPS—and only SPS—now offers you in *standard* socket cap screws:

UNBRAKO pHd* with Hi-Life Thread

The advanced fastener for the '60s. New pHd head with increased bearing area gives you up to 2⅓ times as much holding power, safeguards preload, protects your assemblies from loosening under vibration. Radiused root of new SPS Hi-Life thread form drastically reduces stress concentrations at point where most screw failures occur. Result: Twice the fatigue life. Forged heads, rolled threads preserve metal grain flow, add further strength and fatigue resistance. Available with Nylok† self-locking feature if desired. Sizes #0 to 1½ in. in alloy steel . . . full range of plating and other finishes.

Stainless UNBRAKO Socket Screws

Available in a variety of corrosion-resistant alloys . . . and with Nylok. Silver plating and/or molybdenum disulfide can be added as a lubricant to prevent galling and reduce the thread friction sometimes encountered at elevated temperatures. Sizes #0 to ⅜ in. with forged pHd head and fully formed Hi-Life thread.

New High-Performance UNBRAKO K Series

UNBRAKO K16 tension fasteners now replace specials in high fatigue service. They give you *twice* the fatigue life of regular UNBRAKOS; *four* times that of ordinary socket heads—this in a *standard* fastener. Threads rolled, fillet under head cold worked—both after heat treat. Sizes #8 to ½ in. in 8740 A.Q. steel. pHd head, Hi-Life thread.

UNBRAKO KS 812: A stainless socket head cap screw offering a guaranteed tensile strength of 125,000 psi *minimum.* Yet this precision forged, burr-free fastener is a standard, available in quantity from stock. Made of high-grade austenitic stainless, hardened through cold working. Has pHd head for greater holding power; SPS Hi-Life thread form for increased fatigue resistance. Sizes #8 through ⅜ in.

Standard UNBRAKO socket head cap screws are available from stock through your industrial distributor. See him for more information or write Standard Pressed Steel Co. INDUSTRIAL FASTENER Division, SPS, JENKINTOWN 37, PENNSYLVANIA.

*proper Head design (1960 series) †T.M. Reg. U.S. Pat. Off., The Nylok Corporation

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A file . . . is a file . . . is a file . . . and here are thousands, each different, each designed for specific metal removal or finishing operations. Take your pick of the right shape . . . the right size . . . the right cut . . . for your particular needs.

Here are files for every purpose, Swiss Precision Files, Rifflers, Needle Files and many others, American Pattern, Milled Curved Tooth, High Speed Steel Rotary Files—chisel cut and ground from the solid—Countersinks—Tungsten Carbide Rotary Files—each manufactured to unsurpassed standards of quality, precision and performance. And consider these revolutionary new advances in construction . . . FACET TOOTH* and BI-DEX* rotary files that give up to 25-fold increase in life and efficiency over ordinary tungsten carbide rotary files.

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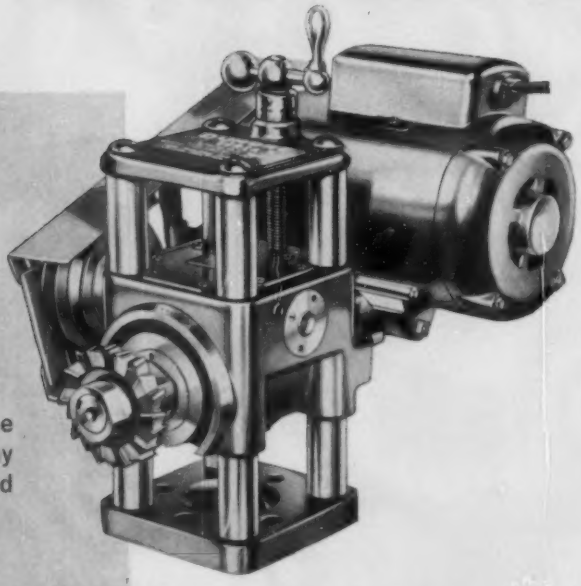
MACHINE ANYTHING ANYWHERE.....



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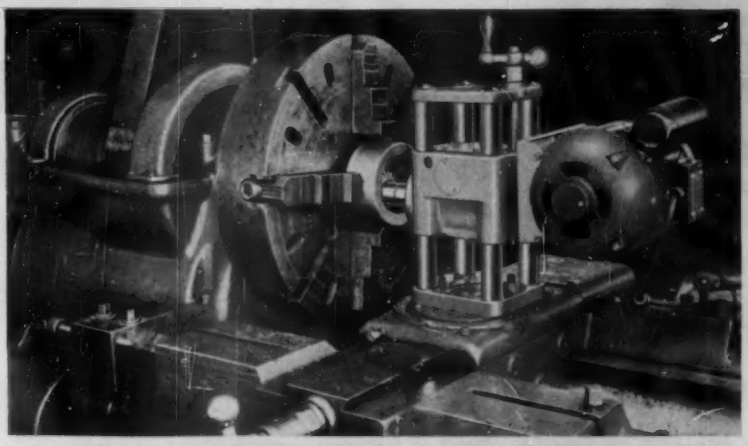
YOUR DUMORE DISTRIBUTOR HAS COMPLETE STOCKS FOR FAST DELIVERY

Use it as a

...machine tool attachment

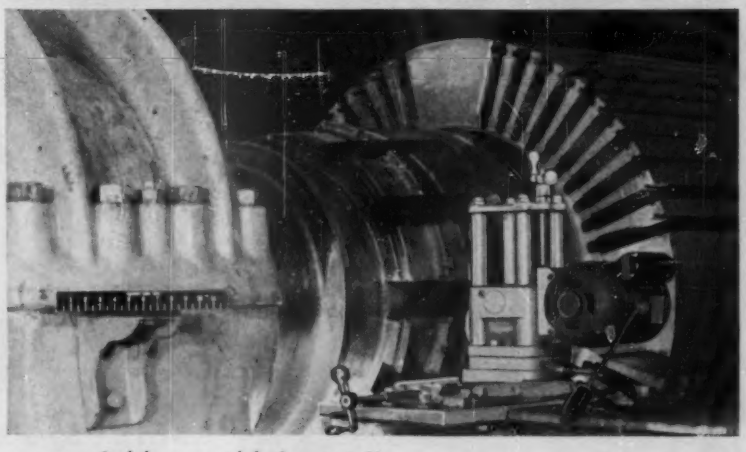
Dumore Versa-Mil combines with any standard machine tool for secondary machining operations.



..AT LOWER COST

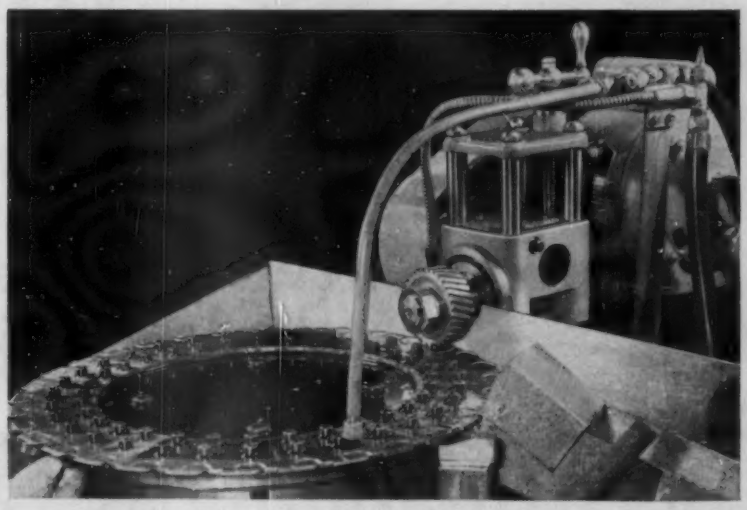
MILLS
BORES
SHAPES
SLOTS
GRINDS, DRILLS

and related machining



...portable machining unit

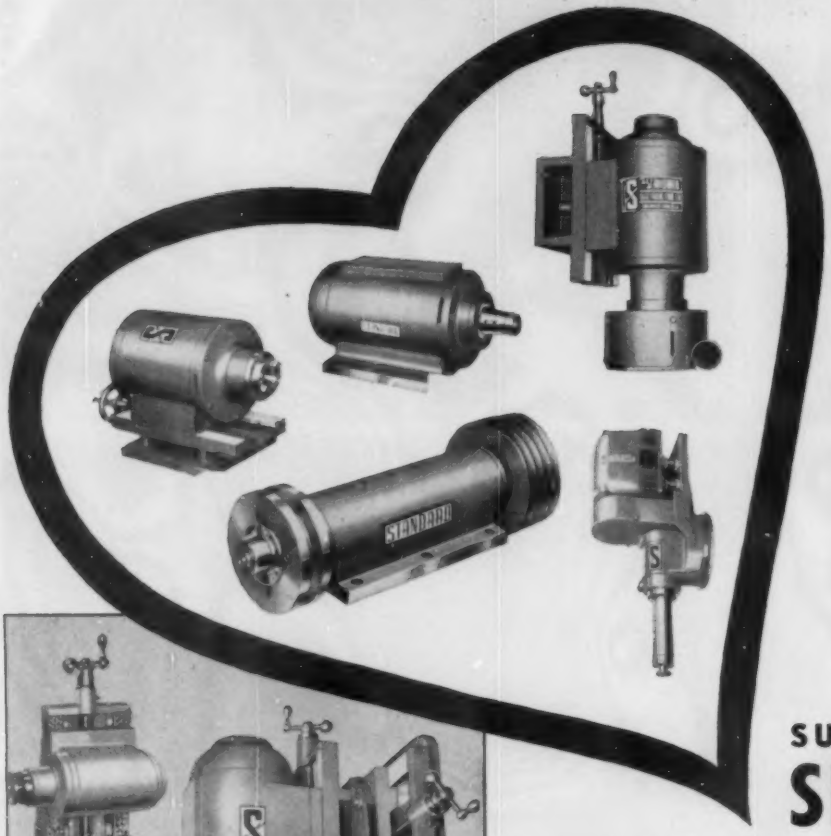
Built-in power and feeds, plus any position mounting, permit Dumore Versa-Mil to in-place machine parts or machinery too big to move or handle in standard machines.



...component for special machines

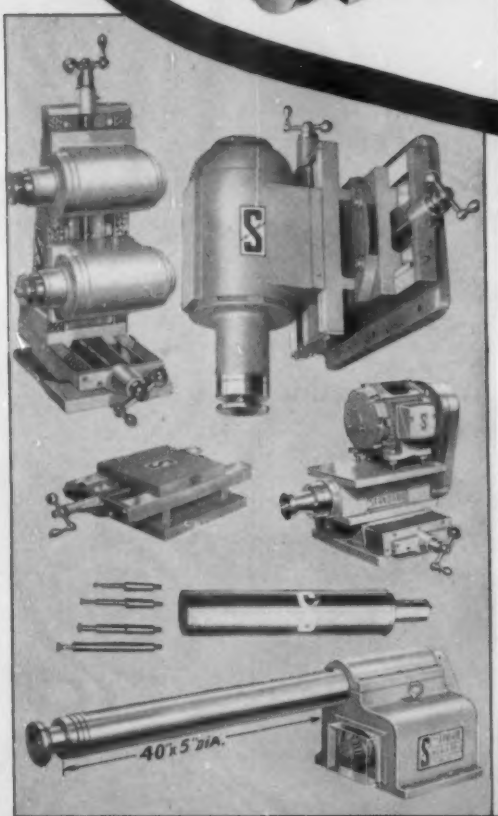
Dumore Versa-Mil adapts readily to special machining set-ups for production applications. Completely engineered accessories and attachments provide versatility for a variety of operations.

SEE HIM FOR A DEMONSTRATION...OR WRITE FOR BULLETIN VM-60-C



THE HEART OF THAT SPECIAL MACHINE

MACHINE TOOL OR CONVERSION



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SLIDES, FEEDS AND TABLES by

STANDARD

Use the "building block" technique on that machine design problem. A Standard Super Precision Spindle **PLUS** the proper STANDARD slide, feed or swivel is truly "the heart" of the special machine that will do **your** special job.
Standard Super Precision Spindles will mill, drill, bore or grind and Standard slides, feeds and swivels will take the spindle to the work, or vice versa, ACCURATELY **A THOUSAND TIMES A THOUSAND TIMES!**

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NOW *the SUPER-SENSITIVE* TESTMASTER

TRADE MARK REG. U. S. PAT. OFF.

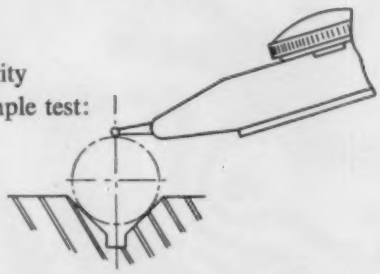
The new Federal Super-Sensitive Testmaster gives you more accurate results than any other test indicator. It's bound to . . . starting tension has been cut almost in half . . . friction has been reduced 25%, making this new Testmaster noticeably superior.

And this improved performance costs you nothing! These new Federal Testmasters sell in the regular price range ($30.00 to $32.50 including Holding Bar, Universal Clamp and Case). This new design is so inherently accurate that, for the first time, you can obtain a model graduated in 50 millionths of an inch (.000050″)!

(Above)
Super-Sensitive Testmaster Model LT-½. Large Dial. .008″ range, .00005″ min. grad.

(Below)
Super-Sensitive Testmaster Model T-2. Regular Dial. .008″ range, .0001″ min. grad. (Large Dial: Model LT-2). Metric Model also available.

PROVE this superiority with this simple test:



Support, in a V block or on centers, a part which is out-of-round in the order of .0002″. Mount the new Federal T-2 or LT-2 Testmaster beside any other test indicator having .0001″ grads. Then rotate part carefully and compare readings. You'll be surprised to see how much more smoothly the new Testmaster responds — how much more accurately it shows the actual variation in dimension.

The new Super-Sensitive Testmasters (Series T) are easily identified by their Satin Chrome bezels. Regular Federal Testmaster (black bezels) are available with .001″, .005″ and Metric grads.

For bulletin and further information, write

FEDERAL PRODUCTS CORPORATION
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Ask **FEDERAL**® *First*

for recommendations in modern gages... Dial Indicating • Air • Electric or Electronic — for inspecting, measuring, sorting, or automation gaging.

A LAPMASTER CAN MEAN BIG SAVINGS...A BETTER PRODUCT

here are more examples of how:

HIGH PRODUCTION RUNS or small lots—both turned out with *consistent* accuracy on a Lapmaster. Day-in-day-out production rates range from a few pieces to thousands per day.

FLATNESS OF .0000116" or less with a micro-inch finish of 2 to 3 RMS is everyday work for a Lapmaster. Uniform accuracy maintained piece-after-piece because conditioning rings automatically keep lap plate flat.

4920 LB. PARTS can be handled—as well as small ¼" dia. pieces. This 84" dia. weldment for a radar tracking antenna was lapped to a flatness and parallelity within ± .00005" on a Lapmaster Model 84.

TALL and SMALL PARTS AT THE SAME TIME. No expensive fixturing required... in most Lapmaster applications only inexpensive masonite or micarta work holders are necessary. Eliminates danger of stresses and warpage usually caused by clamping during grinding.

EXTERNAL and INTERNAL LAPPING IN ONE OPERATION. Versatility of the Lapmaster is demonstrated in this lapping operation on R. R. air brake parts. Reciprocating mechanism runs small lapping block in and out of work while other parts are being lapped on plate.

SHAPE OR FORM NO PROBLEM. Special lap plate and work holder permit lapping of swing check valve. Other simple attachments and holding devices can be furnished to facilitate lapping of "hard-to-handle" or extremely large parts.

Lapmaster®

...THE MACHINE THAT PUT PRECISION LAPPING ON A PRODUCTION BASIS

WRITE FOR THE COMPLETE LAPMASTER STORY

Write for bulletins describing the Lapmaster line and chart on measuring flatness.

A product of

Crane Packing Company

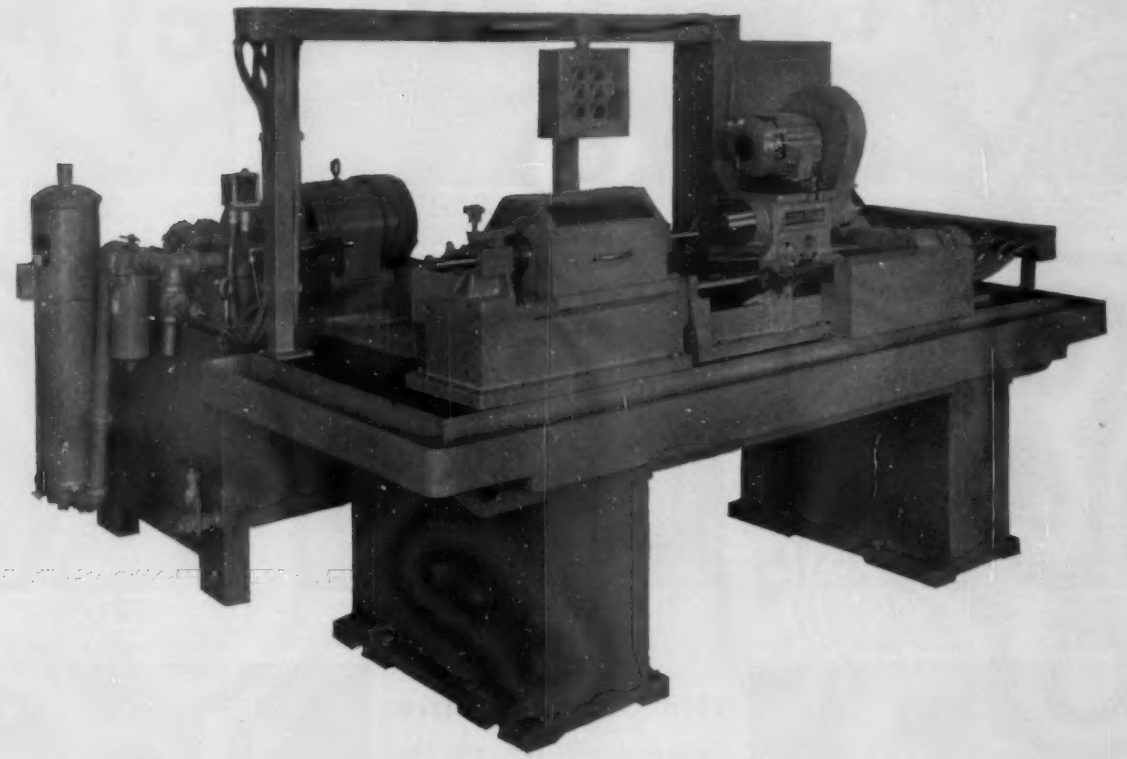
6449 OAKTON STREET • MORTON GROVE, ILLINOIS (Chicago Suburb)

In Canada: Crane Packing Company, Ltd., Hamilton, Ont.

NEW LELAND-GIFFORD HORIZONTAL GUN DRILL

WITH

- *Lead screw or hydraulic feed drilling unit*
- *Base to suit requirements*
- *High pressure coolant system*



Designed to deliver both performance and production, this new Leland-Gifford Horizontal Gun Drill is completely adaptable to your deep hole drilling needs.

Available with hydraulic or lead screw feed to suit your range of hole depths up to ¾" diameter. Can be furnished with traverse up to 48 inches.

An ideal machine for your job can be developed . . . on a standard or custom base, with or without tooling, with or without high pressure coolant systems.

Leland-Gifford's long-established reputation, broad range of experience and complete line of drilling machines is your assurance of the most successful solutions to your drilling problems.

Write for complete information — or ask to have an experienced sales engineer call.

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WORCESTER 1, MASSACHUSETTS
DRILLING MACHINES

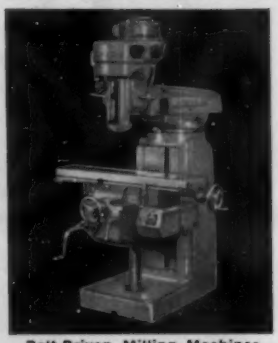
GORTON *THE NAME FOR PROGRESS*

STANDARD AND SPECIAL MILLING MACHINES
YOUR ANSWER TO TODAY'S METALWORKING PROBLEMS!

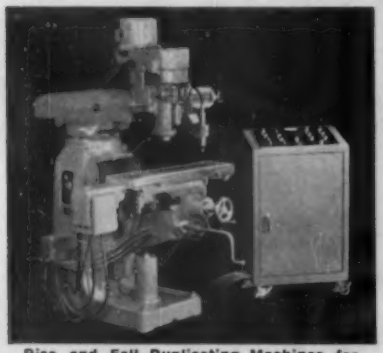
2-Dimensional Pantomills for engraving and light milling —3 sizes.

3-Dimensional Pantomills for engraving, light milling and duplicating — 2 sizes.

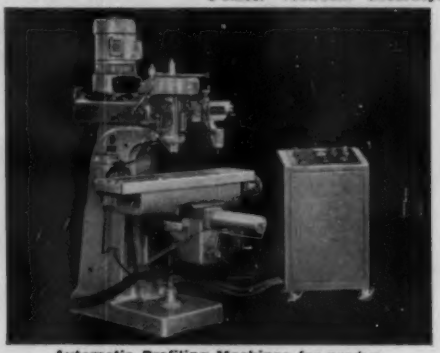
Geared-Head Milling Machines — horizontal, universal and vertical — No. 2 and No. 3-sizes. Toolroom accuracy.



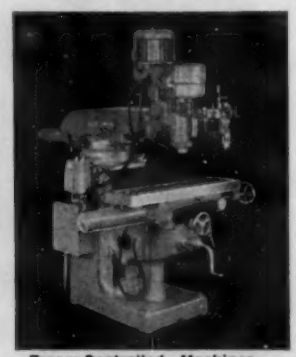
Belt-Driven Milling Machines —vertical and turret types— 3 sizes, 2 h.p. through 5 h.p.



Rise and Fall Duplicating Machines for mold and die applications — 2 sizes through 5 h.p. Completely automatic — ruggedly built — extremely sensitive.



Automatic Profiling Machines for production operations — 2 sizes through 5 h.p. Twin spindles and special design—rugged — sensitive.

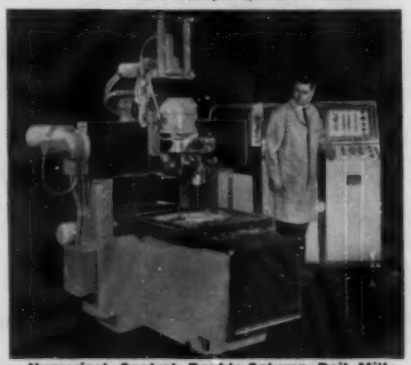


Tracer-Controlled Machines — hydraulic 360° and 3-D for duplicating and profiling—single or multiple-spindle models.

Vertical Jig Boring/Milling Machine for milling, drilling and boring. Large capacity — optical system — infinitely variable speed and feed rates.

THE GORTON LINE

From pantomills to transfer machines, Gorton through imaginative design provides the user with advanced methods. Real savings in time and money are accomplished with standard or special-purpose machines with manual, semi-automatic or automatic controls. Complete line of small tools and accessories available. Write for literature about Gorton equipment which will help solve your metalworking problems.



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A Gorton Product, the Finest of its Kind!

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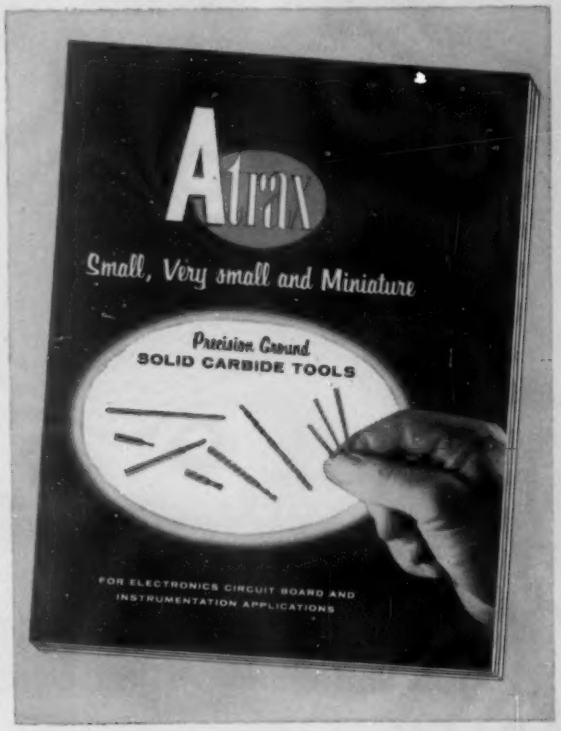
TOOLS FOR ELECTRONICS CIRCUIT BOARD AND INSTRUMENTATION APPLICATIONS

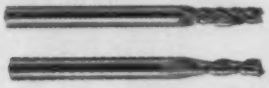


ATRAX MICRO-DRILLS
Wire Sizes #40 through #80.

ATRAX DRILL BLANKS
Wire Sizes #40 through #80.

This brochure is available free. It's a guide for selecting and ordering carbide tools for practically any operation on conventional materials as well as abrasive plastics, fibers, synthetics, laminates and exotic materials and alloys.

ATRAX MINIATURE END MILLS
From 1/32" to 1/8" diameter in 2 flute and 4 flute series.

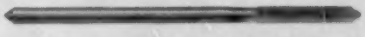


ATRAX MINIATURE STUB ROUTERS
Recommended for routing glass epoxy materials, Fiberglas, phenolics, bakelite, fiber and other synthetic materials.

ATRAX MINIATURE HOLE GRINDING BURS
Hole finishes of 2 microinches or better can be expected using these burs.

ATRAX MIDGET BURS
All burs with 3/32" shanks, 1¼" overall.

ATRAX MINIATURE MICRO-REAMERS
In Fractional and Decimal Sizes. Recommended for all materials up to Rockwell C-56.



SEND FOR THIS NEW BROCHURE NOW!

It will help you to longer tool life, improved tolerances and greater production on hard-to-cut materials.

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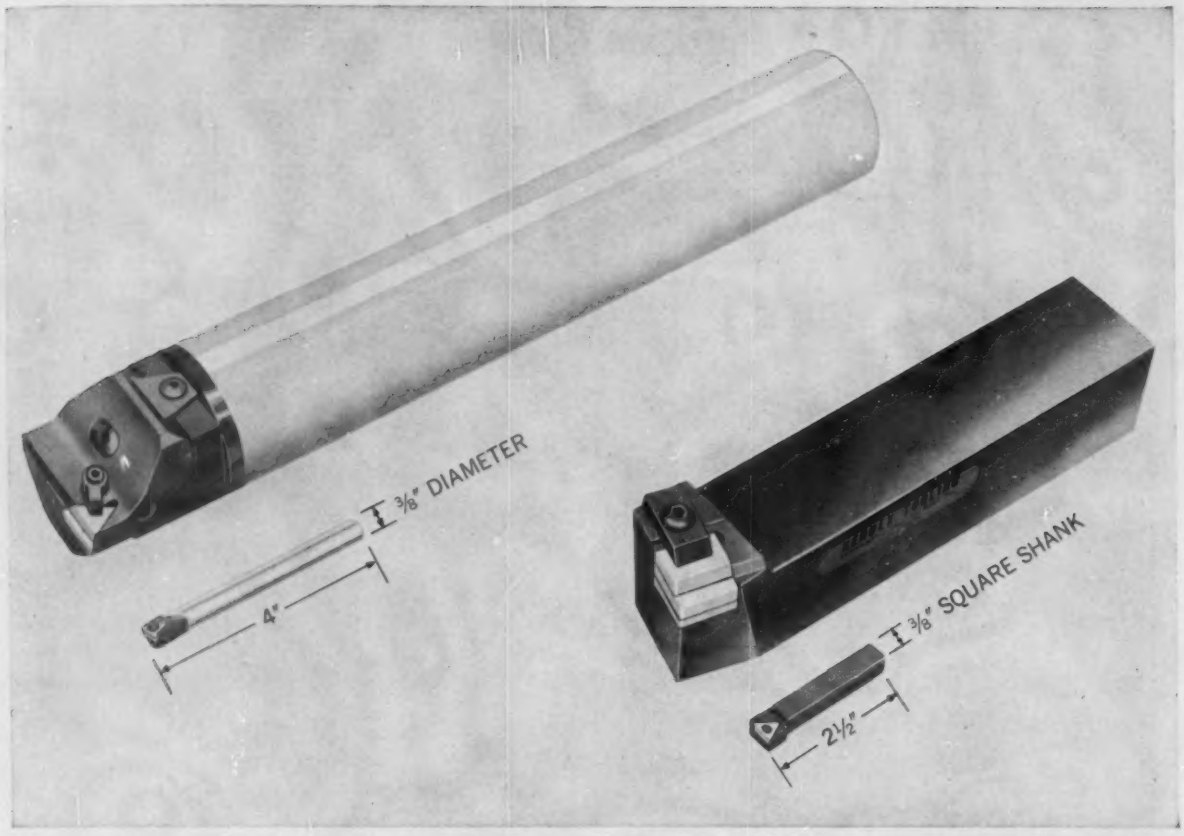

THREE NEW KENDEX* TOOLS: (1) BB-7500 K-Bars with solid Kennametal* shanks and indexable inserts for jig boring, available ½" through 1" dia. (2) Kendex Styles TKA and TKF with ⅜" square shanks 2½" long, screw-on indexable insert. (3) Heavy-duty Kendex with 1" square or 1" I.C. inserts.

BIG ONES OR LITTLE ONES . . . Kennametal has them IN STOCK . . . you can choose from 876 tool items in 199 styles

For machining steel mill rolls weighing tons, or small parts for instruments, or boring holes to extremely close tolerances—Kennametal can supply the right tool from one of 11 warehouse stocks. A full line of standard tipped tools, Kendex "throw-away" insert tooling, steel shank or solid Kennametal boring bars, and many heavy-duty clamped insert tools are included in these stocks.

In addition, Kennametal offers full lines of standard railroad wheel and axle turning tools, face mill cutters, solid carbide fluted tools, and Kendex "Tailored" Specials—either from stock or on relatively short delivery schedules.

Kennametal unquestionably offers the most complete line of carbide metal-cutting tools available from any single source today. Kennametal tooling is backed by a 23-year reputation for consistently high quality products and engineering that has developed many tooling "firsts." A force of 100 specially trained carbide engineers *devote their time exclusively* to the application of Kennametal products.

If you do not have Kennametal cutting tools at work in your plant, a talk with your Kennametal Carbide Engineer might lead to saving many dollars on some of your machining jobs. Call him or write direct for our "Dollars for Pennies" booklet. KENNAMETAL INC., Latrobe, Pa.

Kennametal Single Point Tools In Stock

	Items	Styles
Kendex "Throw-Away" Insert Type	567	130
Other Clamped Insert Types	107	41
Brazed Tip Tools	202	28
	876	199

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38910

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. . . Partners in Progress

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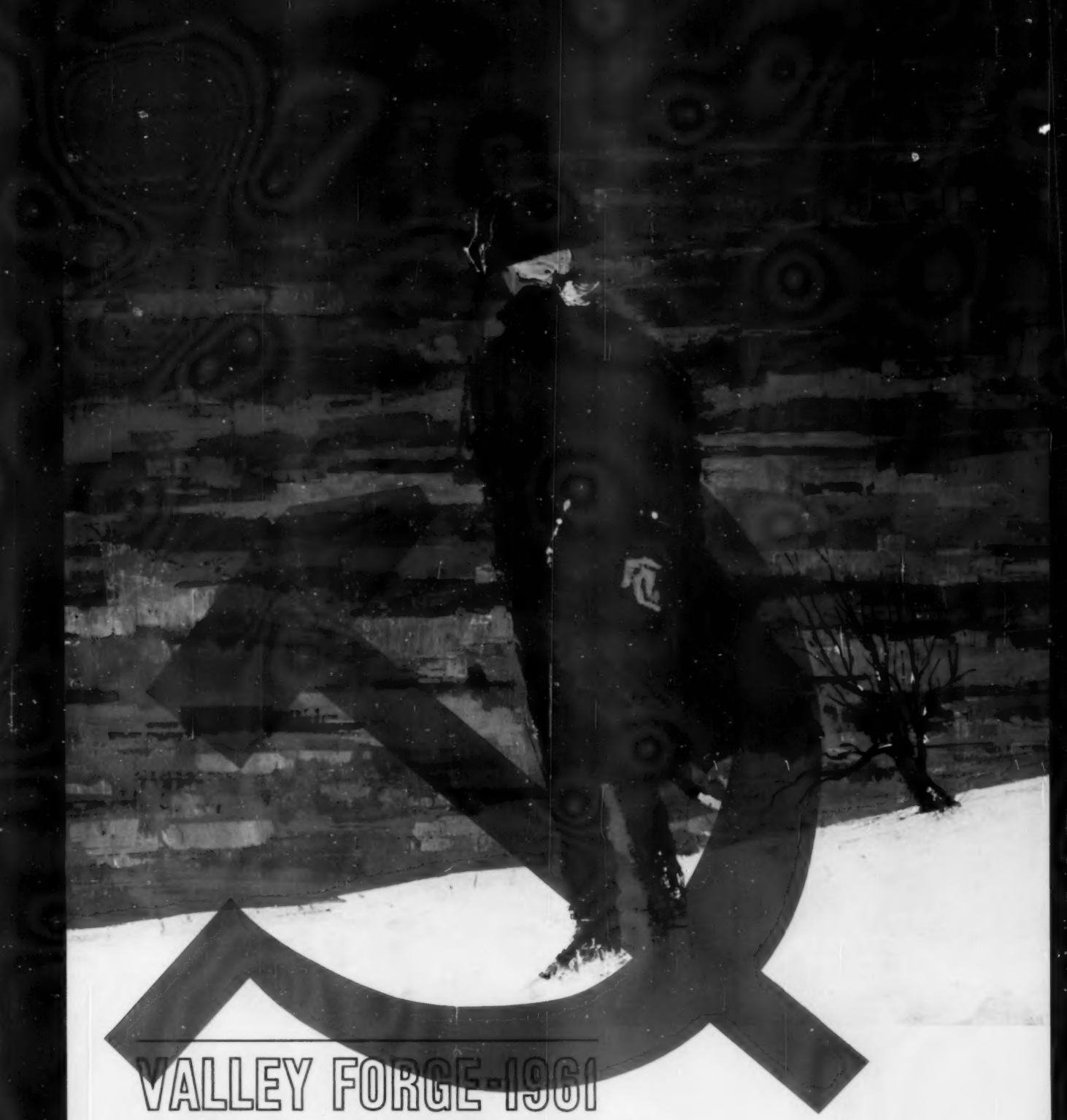

VALLEY FORGE-1961

Nearly 200 years ago, at Valley Forge, we faced disaster. We face it again today, all over the globe, in our fight for industrial survival. Instead of watching competition both from here and abroad invade our established markets—and win the new ones to come . . . instead of waiting for better depreciation laws, we must fight back—now! Money invested in new machine tools—as precise and productive as only Pratt & Whitney can make them—is the first step in annihilating our enemy... obsolescence! We **didn't** surrender at Valley Forge. Will we surrender today? We **can't!** We **won't!**

Pratt & Whitney

HEADQUARTERS FOR AMERICA'S WAR AGAINST OBSOLESCENCE

machine tools / cutting tools / gages

WITHOUT PRATT & WHITNEY MACHINE TOOLS

YOU ARE LOSING MONEY!

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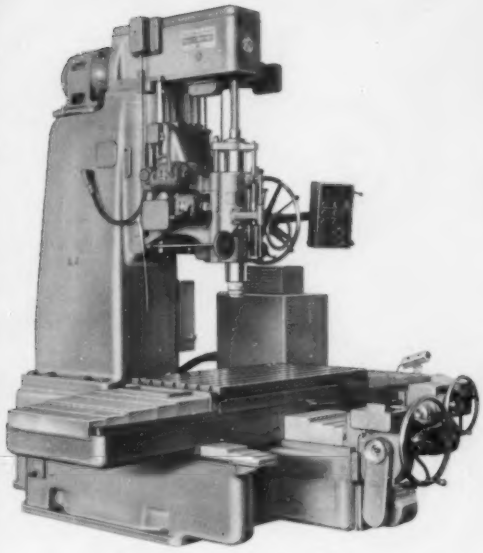
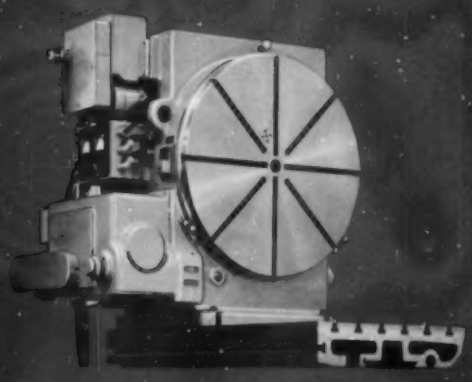
Cuts tooling costs and lead time as much as 75%! Overall production accuracy within ±.001 inch...unusual versatility and repeatability. "Less downtime than any other tape controlled machines in our plant," says one of the country's largest users of tape controlled equipment. The Model D can be bought without an investment in tape preparation equipment—P&W will make tapes for you! When you decide to add programming equipment, P&W trains you to simply and easily handle the entire operation. In either case, you save impressive amounts of money, improve your production capabilities! Also available in tracer controlled models.



NUMERICALLY-CONTROLLED JIG BORER—Model 2E

Cuts jig boring time up to 90%... increases accuracy... offers greater flexibility—all adding up to more money saved. Only P&W jig borers have full floating zero, an electronic check circuit to assure correct positioning, and depth controls that can be utilized without presetting tooling. The exclusive P&W Electro-Limit measuring system retains its accuracy indefinitely, accuracy of millionths of an inch. Your production people can learn how to operation the 2E in as little as 2 hours! Also available in manually controlled models.



ROTARY TABLES

P&W offers the widest line of Rotary Tables in the industry... to give added flexibility to Jig Borers and Kellers... to increase the capacities of these machine tools... to index work for any required angle.

Obsolete equipment in your plant means you are losing money! P&W machine tools eliminate obsolescence . . . they increase efficiency . . . they save time and increase profits. The longer you put off buying new P&W equipment, the more money you are losing. No company can afford this for long!

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Call upon MACHINERY TRADING CORPORATION for a unique way of buying machine tools... Most obsolete equipment exists because plants don't have the cash required to buy new machine tools. P&W eases the burden . . . enables you to buy *now* with less cash outlay! An exclusive **Trade-In** plan—*any* make, used machine tool can be applied to the price of a new P&W machine tool, with tax advantages. Contact Machinery Trading Corp., 545 Oakwood Ave., West Hartford, Conn. Also available, a combination of trade-in and lease-with-option-to-buy; as well as various lease and lease-with-option-to-buy arrangements.

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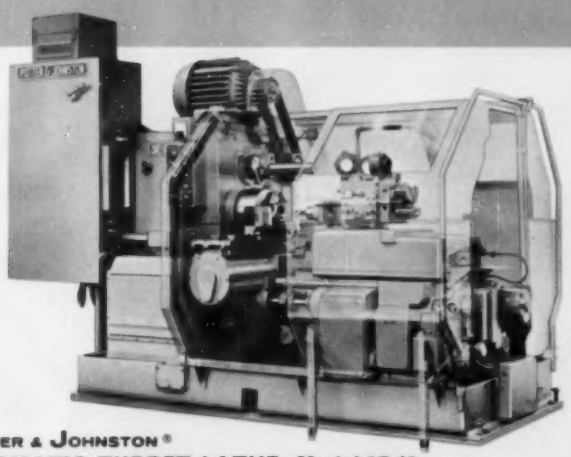

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Cuts machining and set-up time 25%! A rugged, heavy-duty turret lathe with the increased horsepower that means faster metal removal... easier, faster handling of rough cuts. The Model 3E-15 is a turret lathe that you can't afford not to investigate! This and many other models of P&J automatics are available with the added advantage of an inexpensive tape control system.

P&W's recently inaugurated policy of making P&W Cutting Tools and Conventional Gages available through factory-trained and selected Industrial Distributors makes personalized local service available to you . . . to simplify purchasing and speed delivery from local stocks.

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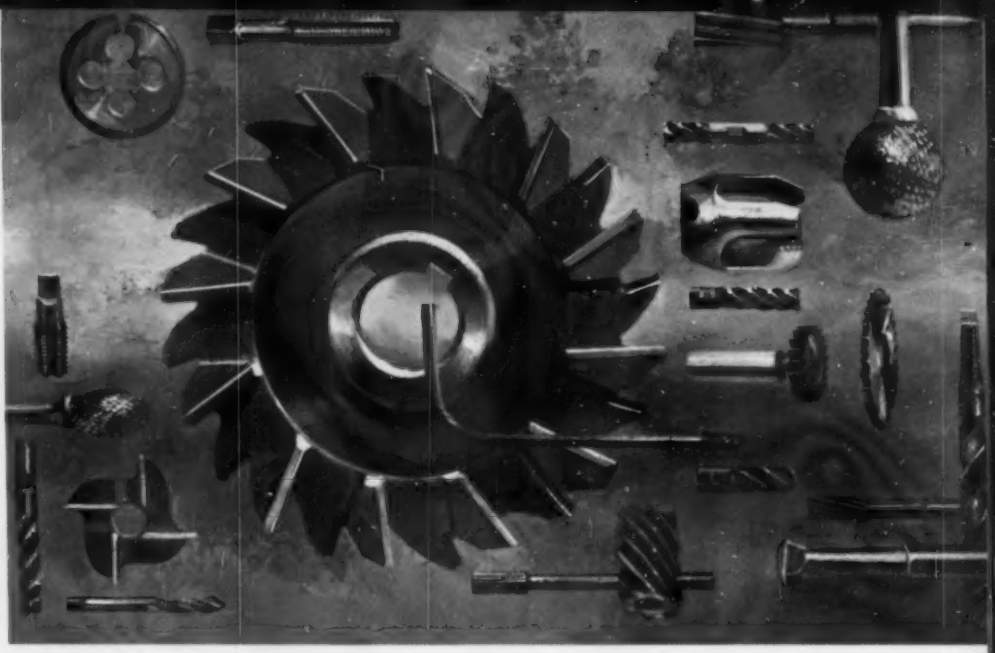

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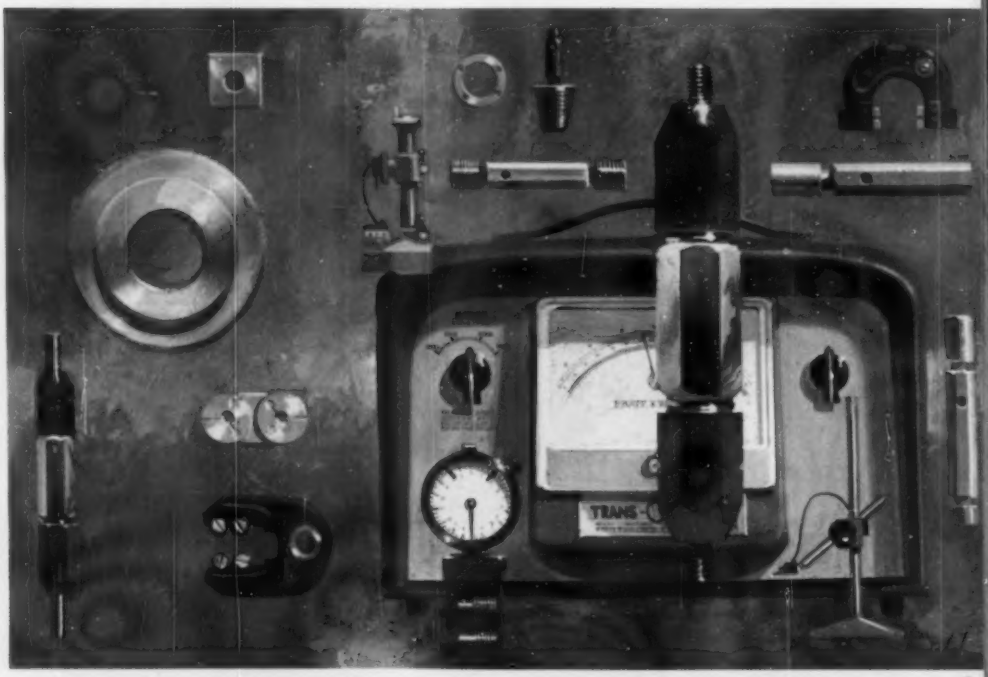
P&W Conventional Gages: Plug . . . Ring . . . Cylindrical, Thread, and Snap Gages . . . Internal and External Comparators, and Precision Gage Blocks. See your P&W distributor for full information. For data on the exclusive series of AIR-O-LIMIT®, SIGMATIC,® TRANS-O-LIMIT® and DATA-LIMIT® Gages and the famous "FLYING MIKE" CONTINUOUS GAGE, see your P&W factory representative.



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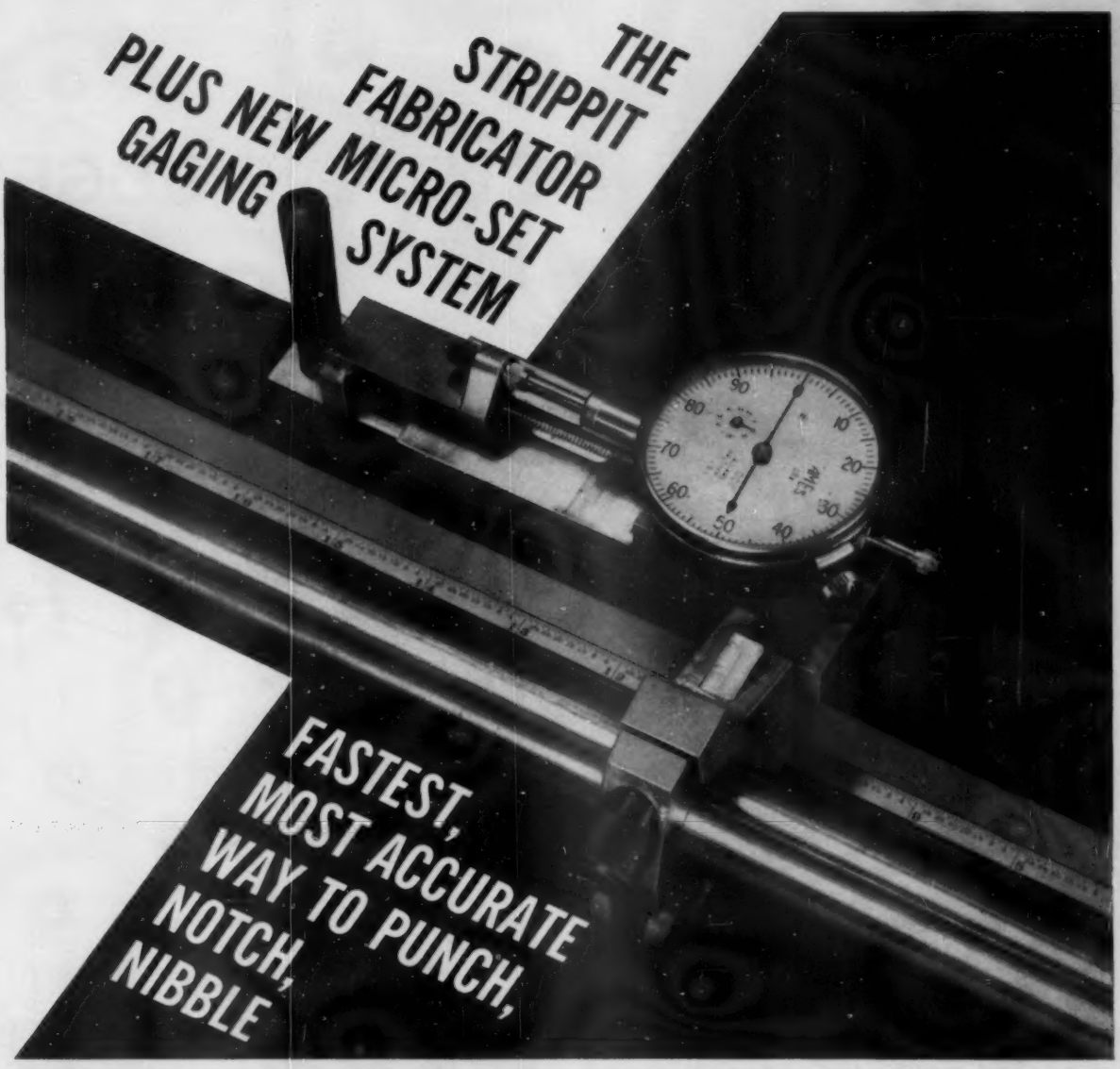

New Strippit Quick-Change Holder with Micro-Set Gaging System for use on any 15-A, 10-AA or 10-A Strippit Fabricator, with jig bored Micro-Bars and Dial Indicators, allows gage settings to the nearest .001" in seconds. Guess work eliminated in close tolerance gaging—spring loaded Dial Indicators provide sensitivity and "feel" in settings. No need for special gages or jo-blocks. Use quick-reading built-in scales when close tolerance gage settings are not required.

This new system, now available on all new Strippit 15-A Fabricators, also quickly adapts to all existing 15-A, 10-AA and 10-A Fabricators. Let your Strippit Tool & Methods Engineer arrange to demonstrate this new Micro-Set Gaging System to you. Or write for Catalog MS.

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is someone in your shop

PLAYING THE CUTTING EDGE GUESSING GAME?

When "the pressure is on," well intentioned persons often do things that appear to save money. However, additional costs are frequently created which are in excess of those believed to be saved. If this could be happening in the selection of milling cutters and blades in your shop, now is the time to find out . . . the time to do something about it.

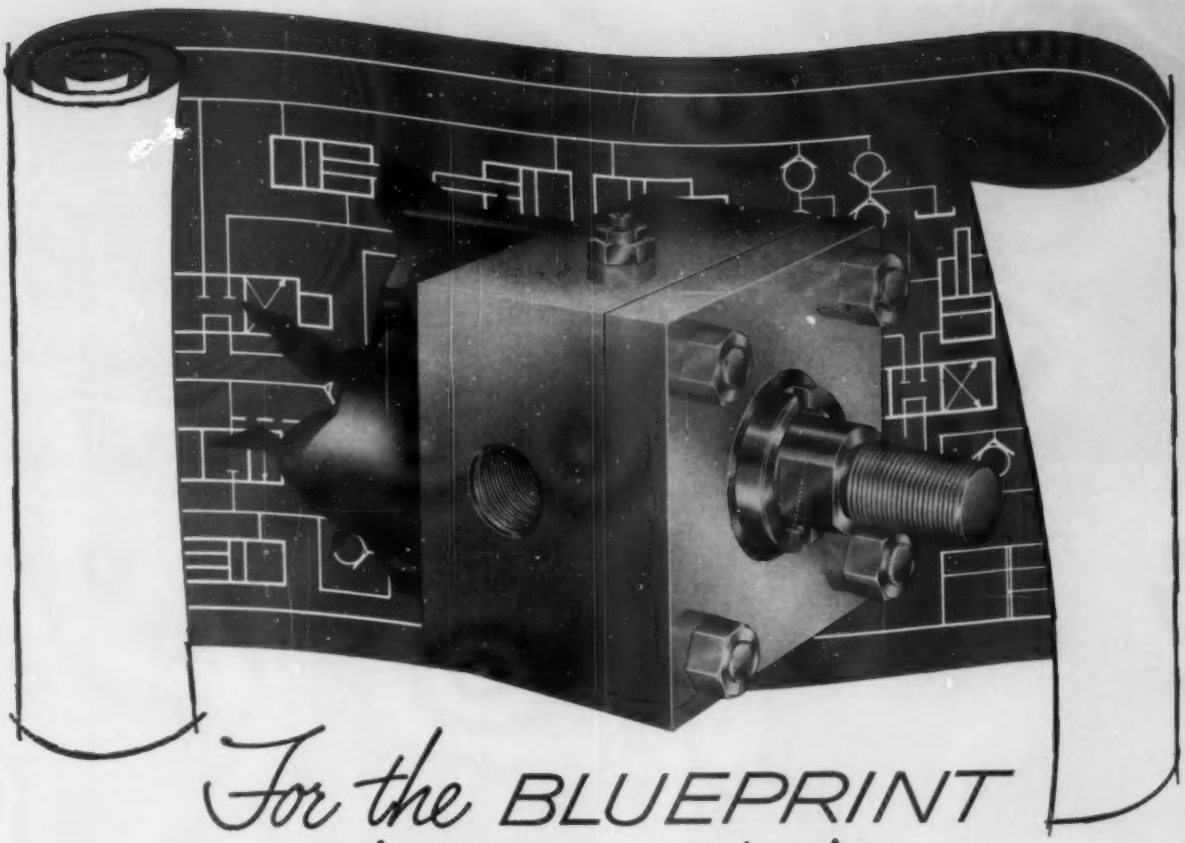
There is a way to be SURE of the most economical cutting edge . . . let us work with you in making an unbiased study of the requirements.

Ingersoll has no favorites. Our job is to get the right type of tool on the job. We have all types of inserted blade milling cutters at work in leading metal working plants. We have engineering knowledge and wide experience to help the user make the most profitable choice . . . the tool which will give the best performance at the lowest *total* cost. In some cases no-grind cutters may be the most practical because they eliminate grinding costs. But, this point must be carefully examined because offsetting additional costs may be involved. In other cases the grind-type may be the best selection because of the importance of finish or accuracy. Yet here too, thorough analysis may lead to better control of overall costs. In still other cases, either the grind or the no-grind type will give approximately the same results and costs.

The proper tool for each job can be determined only by study of the individual requirements. Ingersoll is equipped and prepared to help the customer with this type of study and to provide the type of cutter demanded by each job and each set of conditions.

Milling cutters being tested in Ingersoll's cutter research and development laboratory

If you are interested in eliminating the cutting-edge guessing game in your shop, ask to have an Ingersoll sales engineer tell you about the Ingersoll Cutter Service and the Blade Back-Up Program. Write: **The Ingersoll Milling Machine Company, Cutter Division, 505 Fulton Avenue, Rockford, Illinois.**



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From its blueprint stage to its maintenance engineering requirement sheet, your product will assure MORE power drive precision and service, if T-J cylinders are specified. T-J's complete line too, from the Spacemaker to the new replaceable Squair Head, can be the answer to any power problem. Write or call The Tomkins-Johnson Company, 2425 W. Michigan Ave., Jackson, Michigan, today!

T-J OFFERS THE ONLY COMPLETE CYLINDER LINE

STANDARD HYDRAULIC

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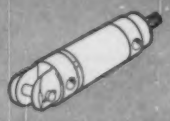
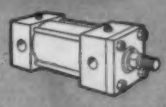


AIR and HYDRAULIC SPACEMAKER



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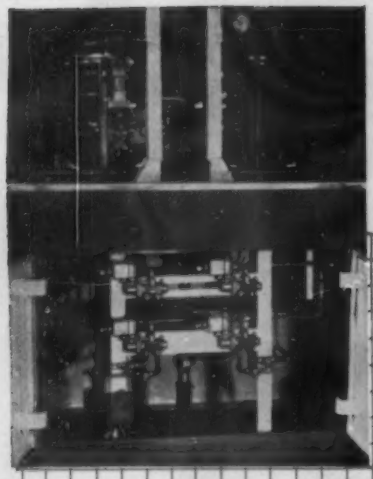
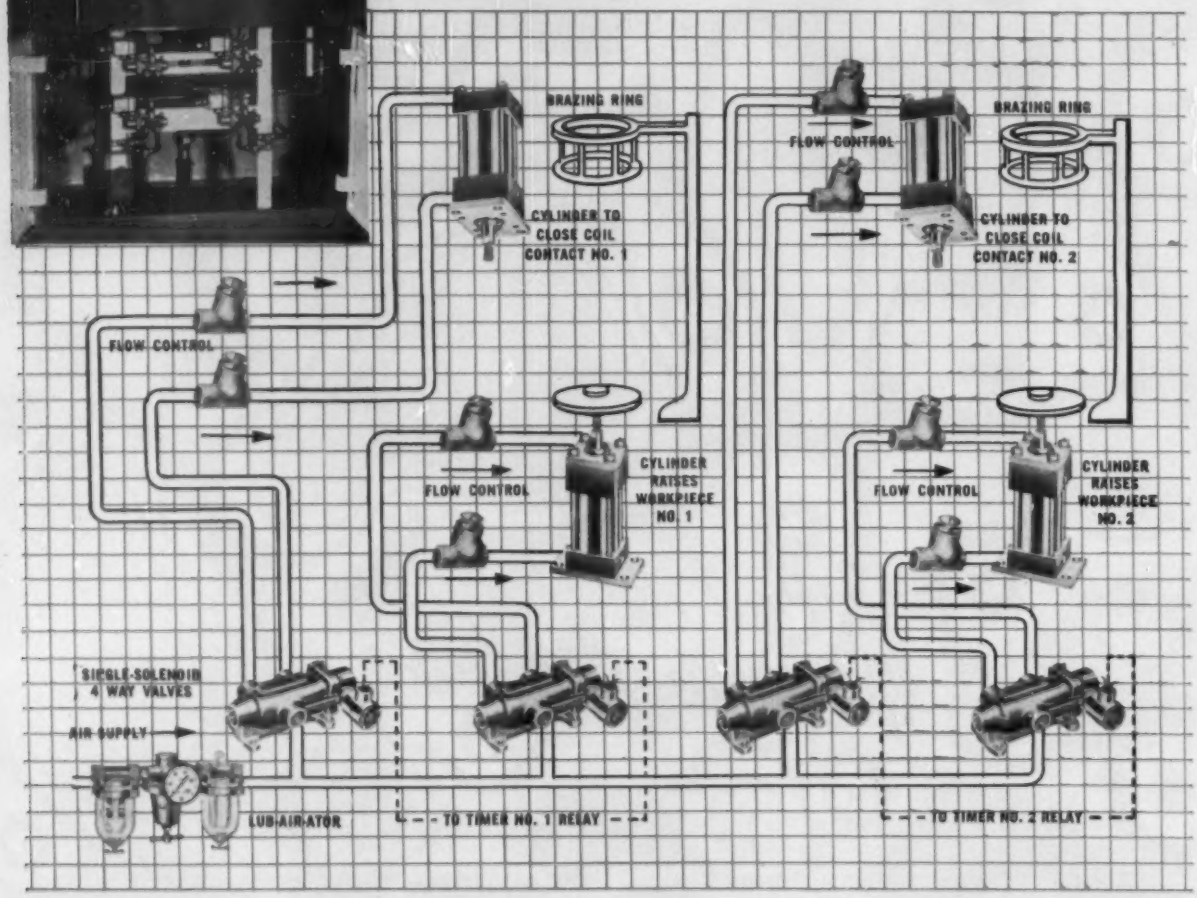


General Electric Company's Apparatus Service Shop in Detroit, Mich., uses Schrader air circuits to actuate and control this brazing machine. It enables one man to braze 120 planet carrier gear assemblies for automotive transmissions in one hour. Double-acting cylinders, actuated by solenoid valves, lift the assembly into position within the coil for brazing the shaft to the gear, and lower it for water quench. JIC cylinders control the induction heating coil contacts. According to Frank A. Ross, the designer, Schrader's Flow Control Valves close contacts so gently that they perform 750,000 cycles before needing replacement. In addition, air works successfully in a strong magnetic field, and the circuits can be simple.



TOUGH BRAZING JOB BECOMES A BREEZE... WITH SCHRADER AIR CIRCUITRY

PROBLEM: Strong magnetic field . . . complex movement of parts . . . speed requirements . . . precise actuation of coil contacts.

SOLUTION: Simple Schrader air control of mass production operations.

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AUTOMATIC TOOL CHANGER — Edlund accessory automatically changes any one of 9 different tools in rapid 5-second change time.

with EDLUND-MATIC MODEL 2N

NUMERICAL TAPE AND DIAL CONTROLLED DRILLING & TAPPING MACHINE

Save Time and Money

The Edlund-Matic eliminates expensive jigs and fixtures by using easy to prepare inexpensive standard 1" 8-channel tape. Floor-to-floor time per part is reduced —saving production time means saving money. Cut lead time of 4 to 6 weeks required for jigs and fixtures to few hours or less for tape preparation and save set-up time. Time saved results in direct dollar earnings.

Increase Accuracy

Increased accuracy means less scrap loss and less wasted production time. Edlund-Matic numerical tape control positions the work and directs the drilling operation quicker and more accurately time after time and eliminates the possibility of human error once the operation has been programmed and checked. Employee fatigue is decreased and free time can be used profitably operating other machines.

Improve Your Product

You can be sure of greater uniformity of finished parts with less inspection required. Tapes can be pre-tested and machine accuracy certified. All this adds up to an improved product at lower cost.

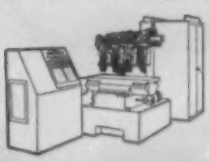
EDLUND MACHINERY COMPANY Cortland, New York

Edlund Representatives in Major Cities

Division of Harsco Corporation

Specialists in Drilling Machine Engineering for over 40 Years

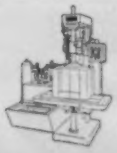
Printed Circuit Board Drilling Machines



Tape Programmer

Infinitely Variable Speed Machines

Gun Drilling Machines



Special Machines

Bath "whips" another threading problem!
NOW...IT CAN BE TOLD!
Difficult quintuple Acme thread completed with 4 taps.
Unusual specifications for this aviation component part presented a challenge to experienced Bath engineers—who successfully designed a close tolerance set of 4 quintuple thread 1 6 pitch. 5 6 lead taps—each with 4 flutes and 5 leads.
These ground from the solid Bath taps are 3 4 — 6 — National Acme. Class 3 Centralizing, left hand . . . and required three especially designed Bath gages for inspection control.
Here's another example of the type of cooperation you may expect from Bath representatives and craftsmen when you have a threading problem. Why not tell us your tapping and gaging troubles!
Inspection requires three Bath gages. One "go" gage (shown in the piece) checks the major and pitch diameters. One "not go" gage checks the major diameter and another "not go" gage checks the pitch diameter.
for the best buy ...buy Bath
JOHN BATH & CO., Inc.
22 Mann St., Worcester, Mass.
CYLINDRICAL AND THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS
44

The above advertisement appeared in March 1958 trade papers.

When this advertisement was prepared, the use for this unusual threaded part was not known.

Now . . . we take pride in finding it was used by Breeze Corporations, Inc., Union, N.J., in the construction of a helicopter rescue winch that recovered our first American astronaut from the sea after his successful flight into space.

This component was threaded with an especially designed set of 4 close tolerance Bath Acme taps, requiring 3 special Bath gages for inspection control.

Quality IS important . . . even in the little things of Life!

JOHN BATH & CO., Inc.

28 Mann St., Worcester, Mass.

CYLINDRICAL AND THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

let's talk CAPACITY

CAPACITY, what does this represent in terms of dollars to a prospective buyer of metal cutting machines.

We at **MICHIGAN** feel that manufacturing **CAPACITY** is an important asset and most beneficial time saving aid available. We constantly strive to improve our manufacturing and assembly methods, this in turn increases our **CAPACITY.** The ability to manufacture machines in less time, results in a low product cost to the customer.

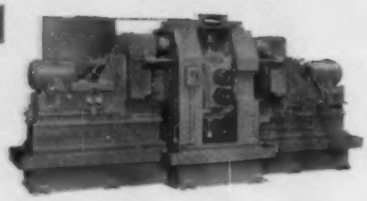
- Modern Building.
- Excellent plant facilities.
- Complete engineering.
- National sales staff.
- Blueprint and duplicating departments.
- Manufacturing facilities to machine every detail in all of our many components.
- **MICHIGAN** designs and fabricates electrical, hydraulic and lubrication installations.

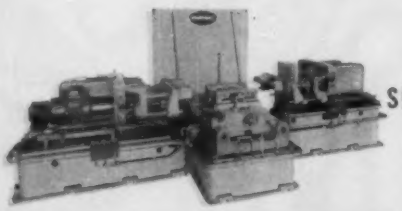
All this represents **CAPACITY.**

MICHIGAN'S CAPACITY pays off in savings to our customers. If you're looking for a special metal cutting machine of any kind, remember **MICHIGAN**—we specialize in dependable delivery, low product cost and excellent service. Send us your inquiries, we will be pleased to serve you promptly.

DIAL

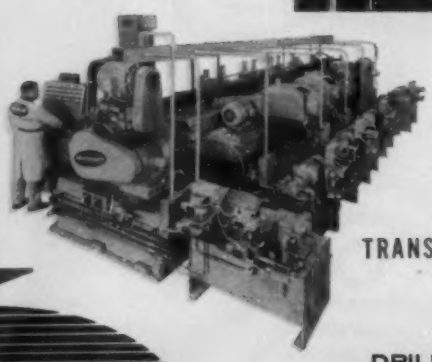
TRUNNION





SHUTTLE

SPECIAL



TRANSFER

TRANSFER
DIAL EQUIPMENT
TRUNNION
SHUTTLE
GUN DRILLING
TAPE CONTROL
DRILL HEADS
FIXTURES

Michigan

SPECIAL MACHINE CO.

11449 TIMKEN AVE. • WARREN, MICHIGAN

DRILLING
REAMING
TAPPING
SPOT FACING
CHAMFERING
COUNTER BORING
BORING
MILLING

Use Reader Service Card, CIRCLE 62

Use Reader Service Card, CIRCLE 63

Combat Rising Costs?

LUCAS

"The advantages of numerical control, combined with the precision quality of the Lucas boring machine are currently reducing manufacturing costs at Sibley on . . .

- **Complicated missile hardware for a major prime contractor.**
- **Short-run lots of gray iron castings for equipment builders.**
- **Major components of the Sibley HT-40 tape controlled drilling machine.**

With this boring machine, only simple work-holding devices are required. Elimination of expensive jigs and fixtures makes the machine ideal for short-run manufacturing—lots of 10 pieces or up to 50 pieces per month have proven to be very economical . . . "

This quote was extracted from material prepared by the Sibley Machine & Foundry Company in South Bend, Indiana. It briefly sums up the story on their model 41 B 48 with Lucas Numra-Tronic Positioning Control to head, table, saddle and rotary table. Your Lucas representative will be happy to fill in the details, or write Lucas Machine Division, The New Britain Machine Co., 12302 Kirby Ave., Cleveland, Ohio.

LUCAS
PRECISION

Choice of Controls?

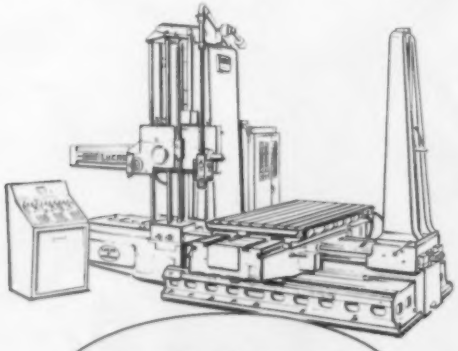
LUCAS

Lucas offers a complete selection of controls for every machine motion. You can select combinations of pendant and lever control, full pendant control and partial or full numerical control.

The Multiple Control Pendant selects speeds, feeds, unit travels, rapid traverse of head, table, saddle and spindle, plus spindle rotation forward and reverse, jog and stop. Preselection of speeds and feeds may be accomplished while the machine is in operation.

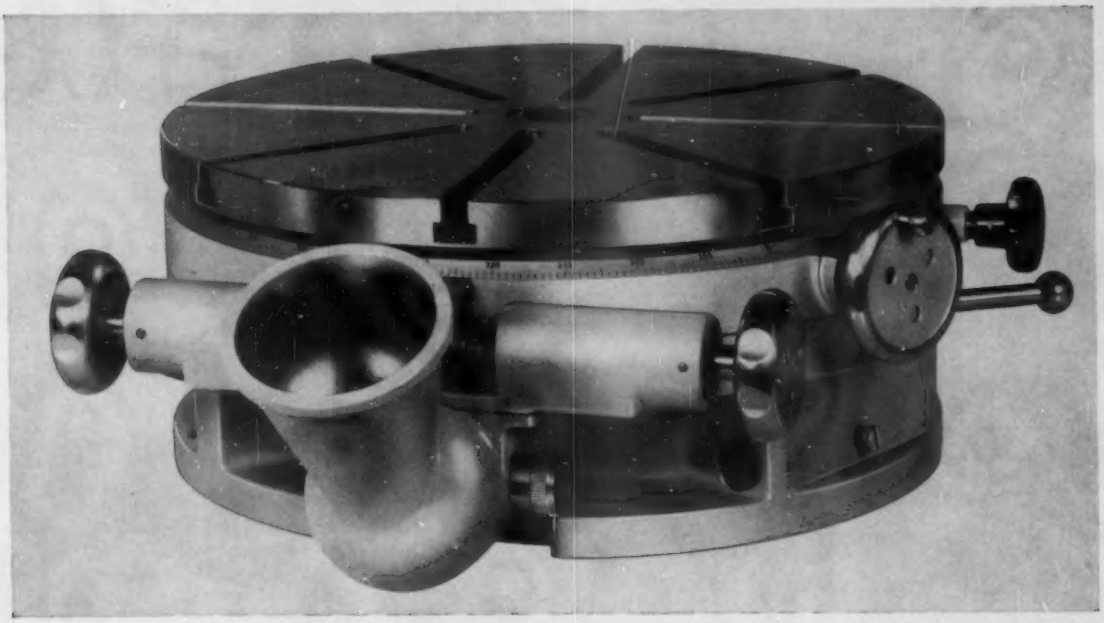
Numerical control can select travel of head, spindle, table and/or saddle, unclamp units when in motion and clamp when directed. Other functions—tapping cycle, changing of feeds and speeds, spindle power tool lock clamps or ejects tools, spindle dwell, coolant "on" or "off", orientation of spindle stop at a desired point of rotation when using tool magazine, simultaneous motion of unit travels, dual storage of information.

One piece or production runs . . . 2¾", 3", 4", 5", 6" or 7" spindle-diameter models, simple jobs or complex jobs, Lucas has the right horizontal and vertical boring, drilling and milling machines with the controls you need. See your Lucas representative or write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Ave., Cleveland, Ohio.



LUCAS
PRECISION

NEW Optical Rotary Table



CARL ZEISS

WEST GERMANY

Unlike conventional instruments, the new Carl Zeiss Optical Rotary Table is equipped with a graduated disc, which is imaged on a big, bright ground-glass (80mm diameter). This makes reading most convenient, speedy and non-tiring.

Its large chucking surface of 400mm diameter, precision setting of 6 seconds, and its sturdy construction enable it to meet the most exacting requirements.

Quick, approximate setting is made by means of a handwheel and a circular graduation of 360°, located on the rim of the instrument. The precise setting of the angular values is achieved by a fine adjustment knob while observing the ground-glass.

All mechanical and optical parts are contained in the housing, safe from dust and moisture.

CENTERING MICROSCOPE

True alignment of the machine spindle and axle of the rotary table is assured by a 20x microscope, placed in the machine spindle above a center point inserted in the rotary table. Both the center point and the centering microscope are equipped with a Morse taper 3. Therefore, if desired, the centering microscope can also be inserted in the rotary table and the center point in the spindle.

An epi-illuminating device can be used in conjunction with the microscope.

Write for booklet on the Carl Zeiss Optical Rotary Table

SOME OTHER CARL ZEISS INSTRUMENTS

Universal Measuring Microscope
Toolmaker's Microscopes
Optical Dividing Heads
Interference Microscope
Light Section Microscope
Gauge Block Interferometer
Circular Division Tester
Stereo Microscope
Technoscope

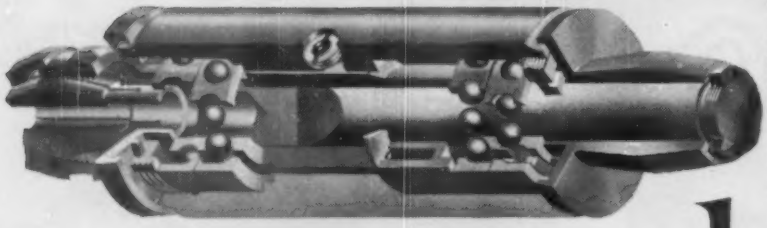
CARL ZEISS, INC.

485 FIFTH AVENUE, NEW YORK 17, N. Y.

COMPLETE SERVICE FACILITIES

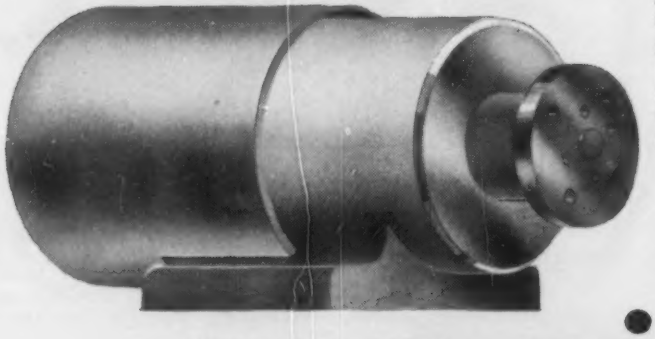
To the nth degree:

accurate



Whitnon spindles are known for accuracy in every aspect: accuracy in machining of all their parts to fine tolerances, accuracy in the application of the finest bearings, accuracy in the use of spring preloading. This view of a Whitnon precision grinding spindle, series B-235, shows the basic concept which has made Whitnon spindles outstandingly dependable.

rugged *for full production*



Whitnon's D-475 is motorized, fan-cooled, grease-lubricated and sealed for life. Adaptable to heavy-duty milling and face or disk grinding, it is available in sizes ranging from 10 HP @ 1800 rpm to 25 HP @ 3600 rpm. It can be provided with electric braking, and with optional tool-mounting specifications to suit your needs.

precision

where precision counts:

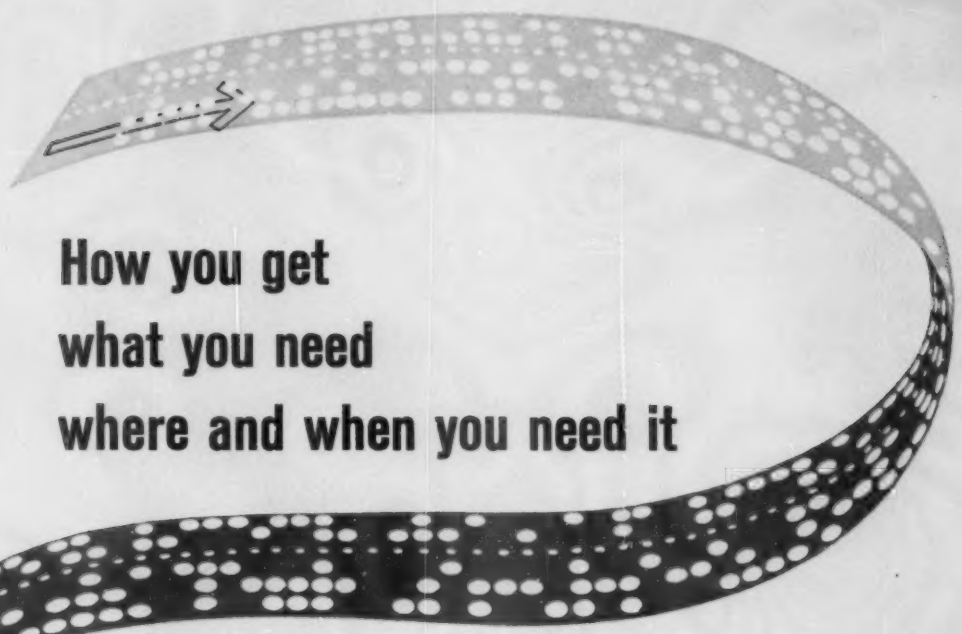
Whitnon

All Whitnon spindles — large or small — have a superior level of precision *designed in*, to assure dependability in high-production applications . . . because Whitnon designers are not just engineers; they're also practical master-machinists who *know* how machine tools behave under load, because they've used them. See for yourself. Ask for Whitnon's useful catalog of precision spindle ideas.

spindle ideas

The Whitnon Manufacturing Company, Route 6 and New Britain Avenue, Farmington, Connecticut.
Specialists in the design and manufacture of precision revolving machinery.
24-hour repair facilities in Farmington and at The Whitnon Spindle Company, 20466 Wyoming Avenue, Detroit.

ANOTHER NORTON PRODUCT



How you get what you need where and when you need it

Suppose you need a shipment of Behr-Manning coated abrasive belts or discs in a big hurry. Time, profit, your customer's goodwill at stake.

You get them for sure . . . with the help of our high-speed electronic processing of orders. Behr-Manning fights to give you service. Maintains warehouse branches in your area (with methods rooms and engineers to help you). Plus the finest group of industrial distributors anywhere.

Service you get—quality too, as in Resinall® belts and discs. They get more work out. They're better . . . because we devote more men, facilities and resources to coated abrasive research and development than anyone.

BEHR-MANNING CO., Troy, N.Y., a division of Norton Company.

BEHR-MANNING
Abrasive Service

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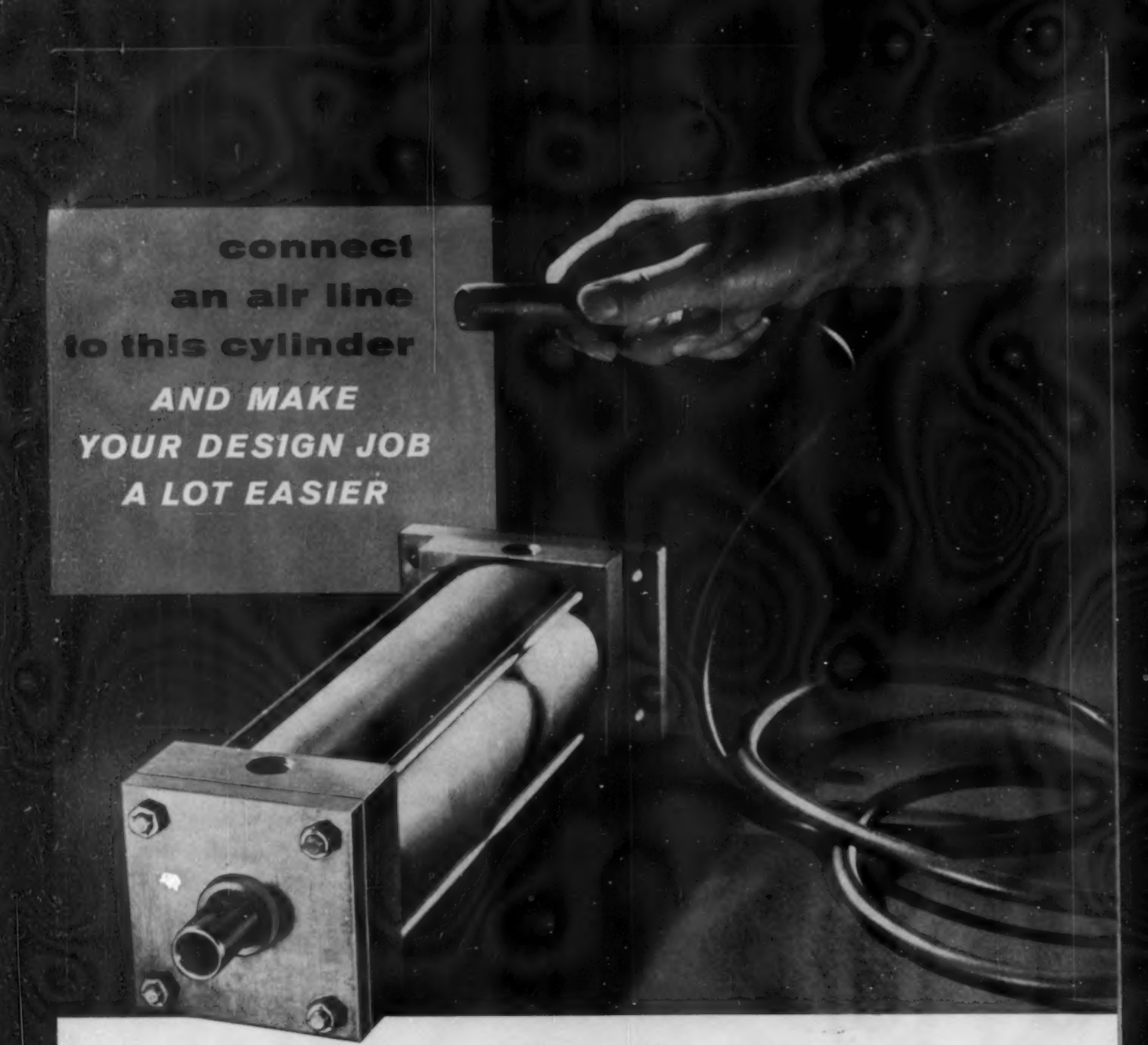

The cylinder simplifies your design work substantially, because it produces virtually any kind of motion—and does so *without the use of complex mechanical contrivances!*

It provides constant, even pressure at all times, and this pressure can be varied with a simple adjustment. Its compact size, along with the use of a flexible line, makes it easily adaptable to special machine design.

If you would like more information about cylinders, or the many other Logan products, just fill in and mail the coupon below.

LOGAN

AIR AND HYDRAULIC OPERATED MACHINES

Check the items you want, fill in your name and address, tear out and mail to:

Logansport Machine Co., Inc. • 740 Center Avenue, Logansport, Indiana

___100-1 AIR CYLINDERS	___200-1 HYD. POWER UNITS
___100-2 MILL-TYPE AIR CYLS.	___200-2 ROTOCAST HYD. CYLS.
___100-3 AIR-DRAULIC CYLS.	___200-3 750 SERIES HYD. CYLS.
___100-4 AIR VALVES	___200-4 and 200-7 HYD. VALVES
___100-5 LOGANSQUARE CYLS.	___200-6 SUPER-MATIC CYLS.
___100-6 ULTRAMATION CYLS.	___ABC BOOKLET
___100-7 SUB-PLATE AIR VALVE	___CIRCUIT RIDER
___300-1 CHUCKS	___CALCULATOR
___300-2 PRESSES	___FACTS OF LIFE

Please send copy of catalog

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

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ANACONDA EXTRUDED SHAPES

preformed to cut fabricating costs

...preferred for superior quality!

Would you like to reduce machining, scrap, and finishing by *cutting* parts from long lengths of extruded shapes?

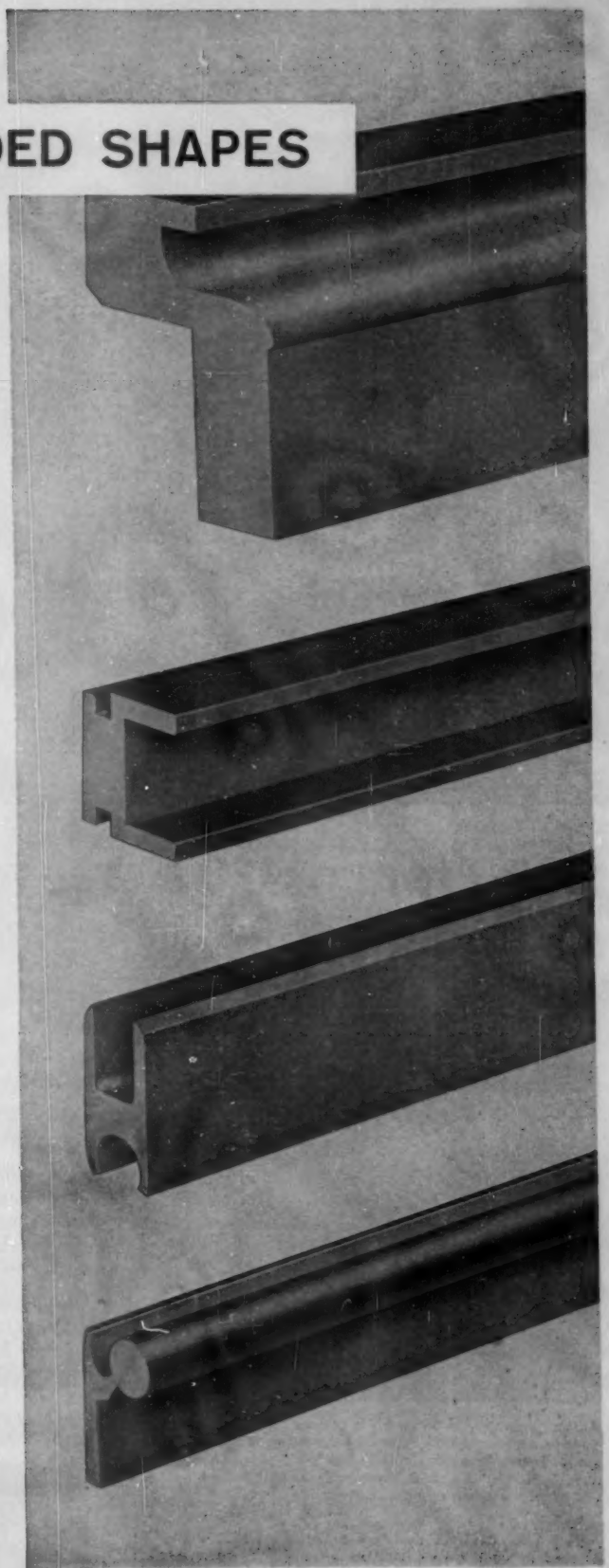
Anaconda shows you how . . . by designing long lengths of "pre-machined" shapes exactly suited to the parts you need. Parts made from these extruded brass shapes are characterized by their strong, homogeneous, wrought-metal structure. They are superior, long-wearing parts that *improve* the quality of your finished product. What's more, the smooth, extruded surfaces also reduce many finishing operations —additional savings for you.

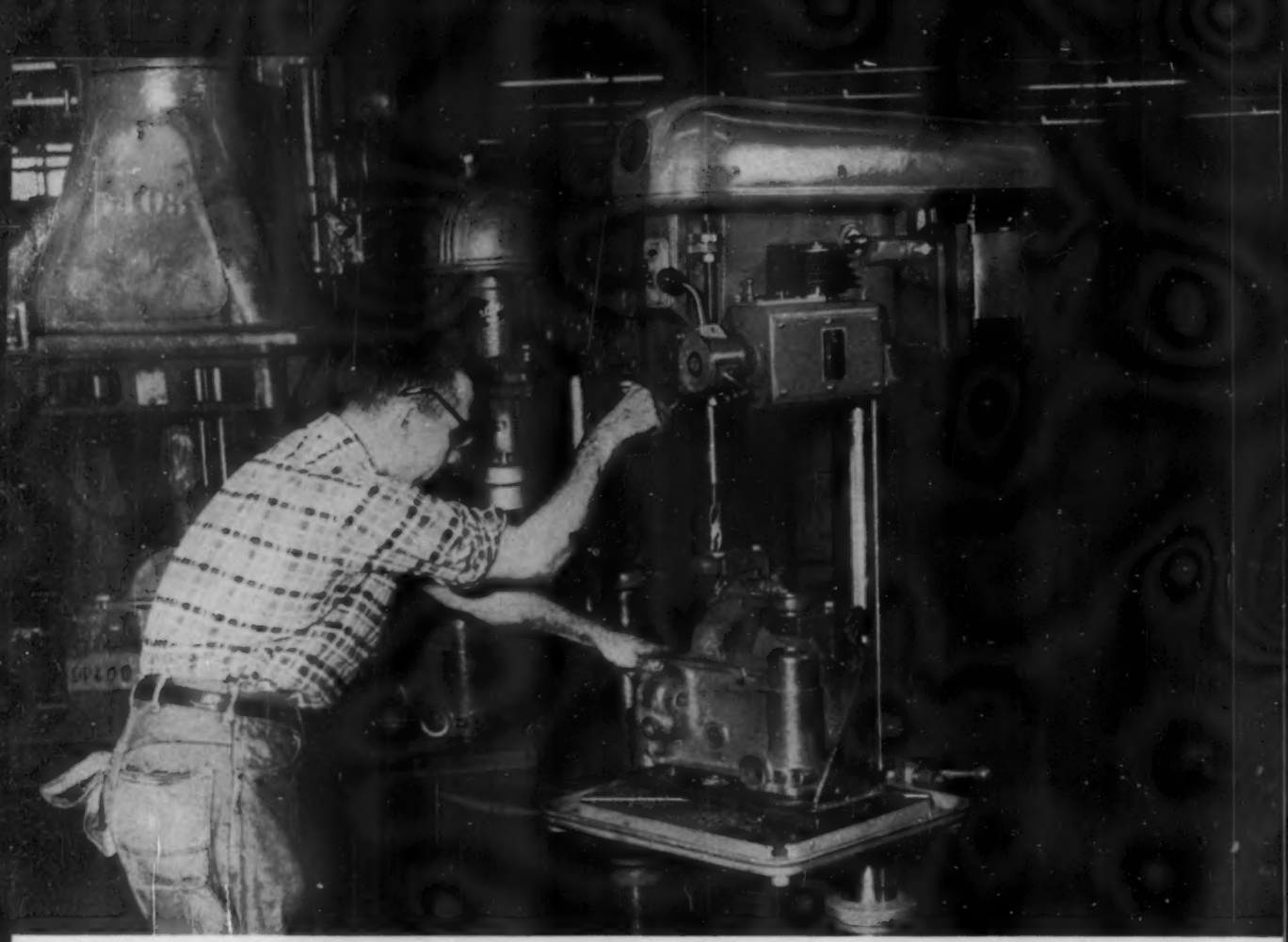
Discover why more and more manufacturers are cutting fabricating costs and maintaining better quality by using these preformed shapes. Let our technical service personnel lend practical—and imaginative—help in adapting extruded shapes to the economical production of intricate parts.

Call your Anaconda representative or write: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 81-1063

EXTRUDED SHAPES

ANACONDA®
AMERICAN BRASS COMPANY





2600 rpm or 110 rpm—you can do more with a Delta 20" *geared pulley head* drill press

All you have to do is turn a key to change from direct belt drive to gear drive on any one of the 28 models of this machine. The 20" geared pulley head drill presses can be used in manual as well as semi and fully automated set-ups to meet a variety of production needs.

FREE BROCHURE describes complete line of 20" drill presses in floor, bench, multiple spindle and overhead models. Write: Rockwell Manufacturing Company, Delta Power Tool Division, 620J N. Lexington Ave., Pittsburgh 8, Pa.

You can drill and tap large holes, do spot facing, reaming and counter-boring at extra slow speeds because these drill presses have planetary gear spindle pulleys which reduce spindle speeds and multiply torque. Hand feed models offer ten speeds, five in direct drive and five in gear drive, while eight speeds are standard on power feed models. Use of a longer than standard belt adds eight more speed selections to either model.

These rugged flexible drill presses have the capacity to handle production metalworking jobs done by machines costing more than twice as much! See them in action and learn how they can help you cut drilling costs and improve drilling quality. Your Delta Industrial Distributor (listed under TOOLS or MACHINE TOOLS in the Yellow Pages) will give you the facts and figures.

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

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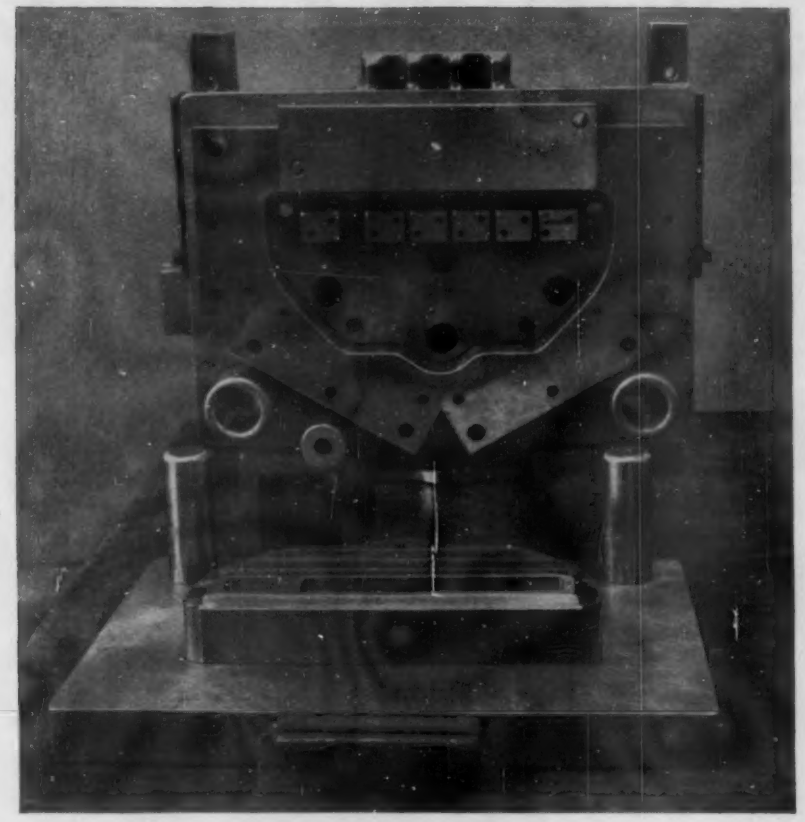
Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Bethlehem Brake Die Tool Steel Forms Vacuum-Cleaner Base Plate

At Remmele Engineering, Inc., St. Paul, Minn., they needed a tool steel with high strength to handle a difficult forming operation on sheet steel. The part, a base plate for a vacuum cleaner, was produced by a die made of Bethlehem Brake Die tool steel.

Engineers at Remmele liked Brake Die's well rounded combination of fine mechanical properties. They also found it a time saver because it machined so readily. Best of all, it produced thousands of pieces before slight redressing was required.

This tool steel requires no heat-treatment

Brake Die is ideal for intricate bending and forming dies because it combines high wear-resistance with high strength. It requires no additional heat-treatment because it is furnished in the heat-treated condition, ready for machining into a finished die. Brake Die is quenched and tempered in our shop to develop its superior properties. Then we straighten it mechanically and give it a stress-relief-anneal to remove straightening stresses.

Your Bethlehem tool steel distributor has Brake Die on hand in many sizes and sections, ready for prompt delivery. Give him a call today.

Use Reader Service Card. CIRCLE 71

BETHLEHEM TOOL STEEL ENGINEER SAYS:

For Uniform Service from Tools, Control the Surface Chemistry

One of the most difficult problems in the use of tools is non-uniformity of service life. Absolute uniformity in production from all identical tools is not expected. But wide variations in service life from one tool to another, or from one lot to another, present a real problem.

It has been found that the most frequent cause of non-uniform service is the variation of chemistry on the tool surfaces. Small amounts of surface carburization or decarburization usually are unnoticed because they can be detected only by destructive testing.

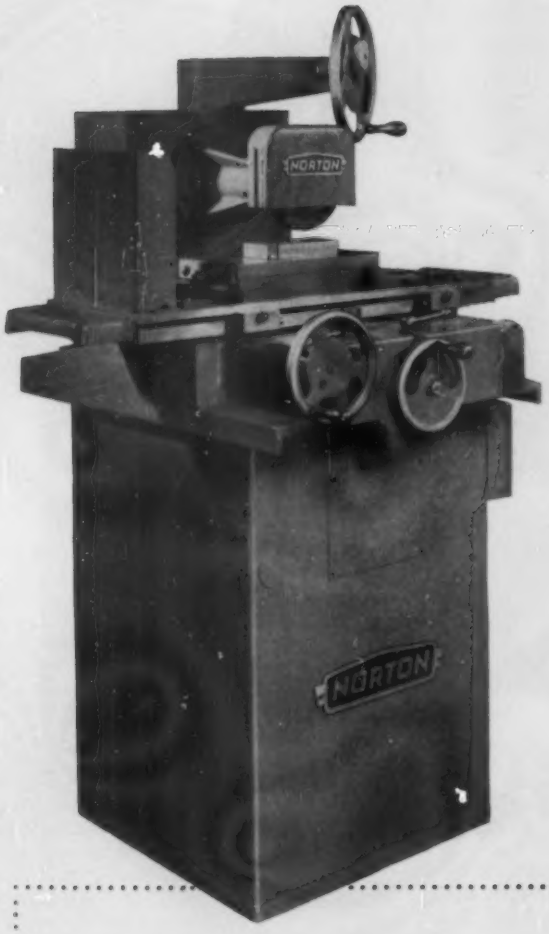
Decarburization on working surfaces of tools causes a decrease of normal service life. And varying amounts of decarburization from tool to tool will cause variable decreases in service life.

Carburization, on the other hand, is not always harmful. Many tools last longer if a carburized case of the optimum depth and carbon content is present. This is true whether the carburized case is intentional, or whether it is accidentally and unknowingly present. The extent to which a carburized case either increases or decreases service life of tools must be determined by experience with the actual tools under consideration. It is therefore possible for tools with a "neutral" surface to be either better or poorer in service life than tools having a carburized case.

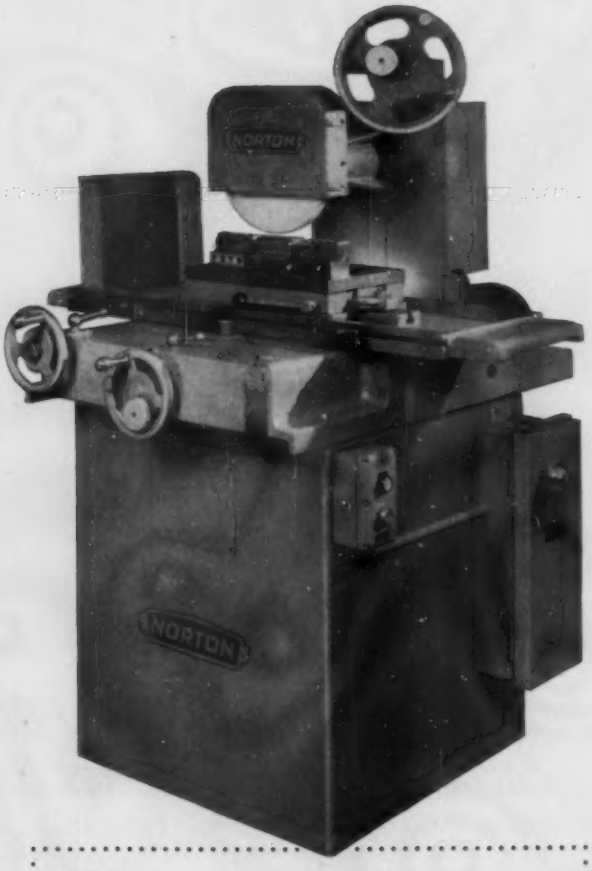
The surest way to provide uniform surface chemistry is to grind the tools adequately after the hardening operations. The only alternative is to be sure that "neutral" heat-treatment equipment is actually doing the expected job of providing unground hardened tools with neutral surfaces.

Announcing

New Norton Hand



NORTON 6 x 12" Type TS Hand Surface Grinder Table travel up to 14". Cross traverse up to 7". Maximum height capacity 12½"*. Grinding wheel, 7" x ¾" x 1¼". Table traverse by hand through positive cable drive. One revolution of hand wheel moves table 6⅝", on friction-free ways.



NORTON 10 x 16" Type TS Hand Surface Grinder Table travel up to 18", cross traverse to 11", grinding wheel 12" dia. Extended wheel head ways assure maximum grinding support and full use of 12" vertical* capacity. Two-speed wheel drive. Fine cross-feed increments of .0005".

*Table top to bottom of full size grinding wheel.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Surface Grinders....

Latest Norton developments...
simplified, rugged, versatile...
are welcome cost-cutters
for your daily toolroom jobs.

Like all Norton grinders — from highly complicated automatic production machines to simpler toolroom types — the new TS Type Hand Surface Grinders have the common denominator of *precision performance, easy operation* and *long service life*, built into them as follows:

Precision Performance. Two-speed wheel feed hand wheel has graduations of .0005" for fast, accurate positioning, plus a vernier scale graduated .0001" for precise grinding feeds. Rigid and long vertical slide and saddle design provide maximum support for moving parts, resulting in reduced vibration and better finish. Accuracy of center-guide cross feed is excellent for groove and shoulder grinding.

Easy Operation. Controls are at working height, for fatigue-free table and cross feed operation. Antifriction bearings under the table produce a smooth and easy motion for reduced effort. Table and cross slide controlled by hand wheels with no levers requiring crossed-arm operation when motions are simultaneous. These grinders are the only machines of their type with hinged wheel guard for quick wheel change.

Long Life. Anti-friction spindle is mounted in housing for rigid, rugged strength. Long vertical slide ways eliminate wheel "hang up" tendencies and provide large way areas. Deep saddle eliminates rocking, gives strong support for grind. Antifriction rollers cut wear on table and cross slide.

Over-all economy of NORTON TS Hand Surface Grinders is strengthened by many features such as their uncomplicated, accessible mechanisms and clean, uncluttered design which reduce maintenance costs. For details on how these new NORTON developments can cut your own daily grinding costs, see your Norton Man, a Trained Grinding Engineer. Or write to NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. *District Offices:* Worcester, Hartford, Chicago, Detroit, Cleveland.

In Canada: J. H. Ryder Machinery Co., Ltd.. Toronto 5.

NORTON
MACHINE TOOLS

75 years of . . . **Making better products . . . to make your products better**

MACHINE TOOL DIVISION: Grinding and Lapping Machines — B & E DIVISION: Shapers • Gear Cutting Machines • Gear Induction Hardeners

Do You TIPTOE THROUGH THE TOOLING?

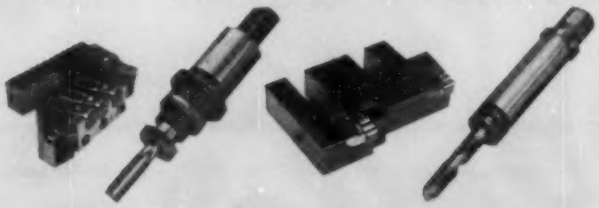
"Packaged setup" . . . a new tooling concept by Scully-Jones . . . practically eliminates downtime for conventional time-consuming setups and tool changes that control economic lot size. Downtime for change-over of automatic chuckers can be cut 50 to 75%. Consider a conventional rerun requiring 2 or 3 hours for setup. With Quick-Set tooling, you can change over and cut the first piece in 30 minutes. The complete "package" includes installing chuck jaws, changing gears, setting trip dogs, inserting preset tools (ONLY 2½ MINUTES) and running the first piece. This means it is now economical to use mass-production techniques on short runs. Turret lathe jobs fit automatics. What is the profit significance to you? Parts inventory costs the average company from 18 to 25% per year. By transferring short runs to automatics and reducing lead time, thousands of dollars can be saved in inventory costs. For chuckers, multiple-spindle automatics, and almost any other machine tool, your S-J representative can provide Quick-Change, Quick-Set Tooling.

Scully-Jones and Company

1915 South Rockwell Street, Chicago 8, Illinois

SCULLY JONES

QUICK-CHANGE
QUICK-SET TOOLING



Tools can be inserted in only two and one-half minutes.

The Secret of Automation

This is supposed to be the Age of Automation. In a limited sense, it is. In some plants, numerically controlled machining and inspection have led to phenomenal increases in productivity. In other plants, transfer machines, rotary index machines and the like have taken much of the drudgery out of manufacturing. Computers are making it possible for the first time to take some of the guesswork from manufacturing planning and production control.

And yet in most plants, automation is nothing but a word. The automatic control of production processes is not feasible—economically or practically—in the majority of plants in this country. Or at first glance it may not seem so.

At the same time, older production methods are on their way out. They are doomed by the facts of life in a competitive world—the cold facts of economic survival. Companies and nations that fail to apply new and improved manufacturing methods soon lose business, ultimately go out of business. There's always a company or nation that is prepared to undertake the impossible—and to make it an actuality on the production floor.

Automation means greater manufacturing efficiency. It may or may not mean numerical control, transfer machines and the other well-publicized appurtenances of manufacturing progress.

The real secret of automation is ingenuity—the kind of ingenuity that is America's real secret weapon in its battle for economic survival.

This kind of ingenuity requires two things: a knowledge of how similar manufacturing problems have been solved and a knowledge that no ideal solution to any manufacturing problem has ever been devised—that existing methods can all be improved. And it requires an ability to "get the most out of the least"—to get the greatest possible productivity out of the least investment in time, labor, tools and tooling.

There are cases where an investment in a few fluid power cylinders and some simple fixturing has enabled a company to improve a production operation, achieving efficiency as great as that obtainable with a new $50,000 production line. In other cases, the new production line may be the best choice.

As a tool and manufacturing engineer, decisions of this kind are up to you. Your Society, through this magazine, through seminars, through conferences and expositions, through chapter meetings, does its best to make sure that you have all of the necessary facts at your disposal.

But no one in your Society can tell you whether or not you ought to automate the operations in your plant. That's up to you. Your know-how, your ingenuity, are the real secret of automation in your plant.

W. Moreland

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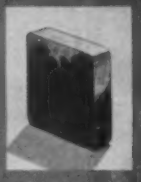
METALLURGICAL BREAKTHROUGH!

NOW FROM UNIMET
. . . A CARBIDE ADDITIVE
CALLED UNIBRAZE*
THAT PERMITS FASTER, STRONGER
BRAZING OF CARBIDES TO STEEL

Conventional Carbide Blank resists the flow of the brazing alloy. The alloy "puddles" — must be forced over the surface of the blank.



Unimet Carbide Blank with Unibraze facilitates the flow of the alloy. Works at 200° to 500° F lower temperatures. Makes braze up to 30% stronger.

By using Unimet Carbides with Unibraze you eliminate all pre-braze sandblasting . . . save additional time on each individual braze . . . produce a far better bond.

*Patent applied for

Unimet Carbides has achieved a metallurgical breakthrough that greatly simplifies brazing. The addition of an original additive —Unibraze—to Unimet Carbide blanks makes the job easier at every step. Here's what Unibraze does: 1. Gives you a thoroughly clean tip to use. You need not sandblast it, grind it, or clean it chemically. 2. Eases the actual brazing operation. Unibraze makes the brazing alloy flow over and into all the carbide surfaces quickly and without moving the tip about to facilitate the flow. 3. Unibraze works at temperatures 200° F. to 500° F. lower than usual. This ends the danger of damage to carbide and steel from excessive heat. 4. Improves the strength of the braze up to 30%. 5. Unibraze is especially effective on Titanium-bearing grades of Carbide.

Order Unimet Carbide Blanks for your plant. On a trial basis we will treat them with the Unibraze additive at no extra cost. Your inquiry will receive prompt attention. Remember that Unibraze is an exclusive with Unimet.

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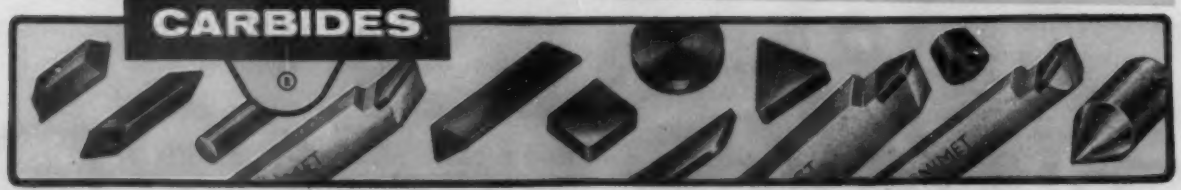


ENGINEERING REGISTRATION

—are national standards needed?

By Joseph B. Smith, Jr.

Standards for professional engineering registration vary from state to state and need to be geared realistically to today's advanced technology. Consequently, professional registration may not be a good measure of the competence of engineers or engineering technicians for specific, specialized assignments.

WITH THE ADVANCE OF MODERN TECHNOLOGY, the responsibilities of engineers in industry and the content of engineering curricula have changed radically. Yet in most states, the requirements for professional engineering registration have changed little over the years. This raises the question of whether these requirements—adequate when they were established—give a true index of professional competence in handling today's engineering problems. Further, there is considerable variation in the registration laws from state to state. Because thousands of companies—and, of course, the Federal Government—operate in many states, their engineers may also work in several states to a much greater degree than was envisaged when the registration laws that are currently in force were written. The adoption of national standards thus appears to have much in its favor, particularly when existing requirements for registration are studied in detail.

Registration Requirements: Requirements for registration vary. Generally, the states are concerned primarily with safeguarding life, health, property, and the general welfare. Knowledge and experience in mathematics, the physical sciences and engineering principles are specifically required or inferred in each state code, act, or law on registration. Particular emphasis is placed on design. Some states register a successful applicant in a category of engineering such as chemical, electrical, mechanical, or mining. Others judge the applicant on knowledge of one engineering branch and of engineering principles but approve him as a registered professional engineer. It is apparently presumed that one so registered will not intentionally accept professional engineering responsibilities for which he is not qualified. In the remaining states the boards of registration evaluate applicants on the basis of demonstrated knowledge of the entire engineering field. They too certify successful applicants as registered professional engineers.

"It is doubtful whether mere knowledge of the physical sciences and engineering is enough to make an engineer truly competent . . ."

Some states grant registration without any formal written examination. Others waive examinations at the discretion of the examining board. Still others do not require examinations for those long established and recognized in the engineering profession.

Scope of the examinations and judgment of the character of an applicant's experience are prerogatives of the board in most states. The objectives of examinations, when they are mentioned at all in state registration acts, are usually specified as demonstrating knowledge of the course content of an approved four-year college curricula, a knowledge of engineering practice, and the ability to perform and supervise engineering work.

> ***"The professional engineer's work is intellectual and not of a routine mental or physical nature. He is capable of exercising original thought and judgment . . ."***

In about one-third of the states, the practice of professional engineering does not apply to persons engaged or employed in maintenance of machinery, equipment, and structures. However, one state does indicate that "the term 'responsible charge' as used in this chapter shall mean the control and direction of the design, evaluation, investigation, alteration, construction, or maintenance of projects requiring initiative, professional skill, technical knowledge and independent judgment."

As a matter of interest, in one state where specialized examinations are required by law, the board does not recognize tool engineering, because it says an examination in this branch would not require an applicant to demonstrate "knowledge of mathematics, the physical sciences and the principles of engineering."

No state includes in its requirements for registration knowledge or experience in the humanities, the social sciences, or particularly in human factors as they apply to the design of public utilities, structures, buildings, machines and transportation systems, despite the expressed concern for life, health, property and the public welfare.

It is doubtful whether mere knowledge of the principles of mathematics, the physical sciences and engineering is enough to make an engineer truly competent, particularly since these principles can now be applied by the computer, which can, in turn, be operated by a technician who may have no real understanding of engineering.

The Professional Engineer: The professional engineer should have a general appreciation and understanding of the humanities and the natural and social sciences as they affect the art and science of engineering, as well as of mathematics, the physical sciences, and up-to-date engineering practices, particularly in his specialized field.

By virtue of his fundamental education and training he is competent to apply the scientific method and outlook to the analysis and solution of engineering problems. He assumes personal responsibility for the development and application of the engineering art and science whether in research, design, construction, operations, maintenance, administration, or teaching the embryonic professional engineer or engineering technician.

The professional engineer's work is intellectual and not of a routine mental or physical nature. He is capable of exercising original thought and judgment and supervising the administrative and technical work of others. Because of his broad education and interests, he can closely and continuously follow the progress of the art and science of engineering and the sciences by consulting published source material and attending conference, seminars, etc. on a world-wide basis. He assimilates this in-

The Other Side of the Question

In these pages, Joseph B. Smith presents a strong case for the adoption of National professional engineering standards. He feels that existing state registration laws, which may have been adequate many years ago when they were written, are inadequate today because of the rapid advances of American technology. Other engineers have argued that present state registration laws are adequate; still others believe that the best answer is for engineering societies to establish their own standards by which professional competence can be determined. The whole subject of professional registration is a complex and controversial one. The editors of this magazine take no stand on this question at present. They feel, however, that it is desirable to air the views of various engineers so that the real needs of the engineering profession—and the public, for whose benefit and protection registration laws are written—can be made known. If you disagree—or agree—with Mr. Smith's views or wish to make your own views on the subject of professional registration known, let us hear from you.

Write to the Editor, THE TOOL AND MANUFACTURING ENGINEER, 10700 Puritan Ave., Detroit 38, Mich.

—the editors

formation and applies it independently. His hallmark is original thought and judgment directed to the future—he engages in planning.

The Engineering Technician: An engineering technician applies proved or established techniques in a particular branch of engineering or area of science under general professional engineering direction. In doing this, he may supervise the work of craftsmen. He requires education and training sufficient not only to apply his engineering and scientific techniques but also to understand the reasons for and the purposes of his responsibilities. In supporting the professional engineer, or the scientist for that matter, typical duties are associated with research, design, development, construction, operations, and maintenance of equipment, structures, and systems, and include tasks such as making computations, applying proper engineering techniques, estimating, inspecting and testing materials and systemic components and the like.

Reasons for Registration: The primary purpose of registration as a professional engineer is to protect the public against incompetent or unscrupulous professional or technical personnel. This procedure provides regulations regarding licensing, disciplinary proceedings, suspension or revocation of a license, penalties for practicing without a license, and the like. Professional service sets up a fiduciary relationship which imposes higher standards of dealing with the public than those commonly used in the marts of trade. Engineering, like many other professions, is subject to legal restrictions when applied to the public.

The point often overlooked is that registration is concerned directly with those professional services affecting public welfare and safeguarding life, health, and property. On the other hand, registration is not required for the practice of professional engineering under many circumstances, provided that no title, sign, card, or device is used in such a manner as to tend to convey the impression that the person rendering such service is a professional engineer duly licensed. Furthermore, at this stage of technological evolution probably only a small percentage of all truly professional engineering work being accomplished directly involves public welfare and safeguarding life, health, and property in the sense inferred by state registration laws.

The fact remains that many engineers today are performing truly professional engineering work; however, the nature and scope of their responsibilities either fail to satisfy the existing obsolete registration criteria or cannot be sufficiently understood by a board to be considered satisfactory professional engineering experience.

Examinations given by most states, being little more than academic exercises in mathematics, the physical sciences, some areas of economics, and many engineering practices outmoded by the exploding technology, reveal few, if any, truly professional capabilities in modern technology on the part of those who pass the examinations. They give little guarantee that anyone who qualifies as a registered professional engineer is competent to practice.

National Standards: Nevertheless, certification is necessary if for no other reasons than to control unscrupulous and incompetent persons and to satisfy legal requirements. Therefore, minimum national standards for both professional engineers and engineering technicians should be established. These standards should be determined and kept current by persons having knowledge, experience, and wisdom in the art and science of engineering and who, by their practice, are able to stay abreast of the modern technological stampede. Persons in both engineering categories should be encouraged to seek certification regardless of their employment not solely in the interest of public welfare, etc., but as formal and official evidence of competency in the total engineering field as a professional engineer or in specific facets thereof as an engineering technician. Also, industry and the state and Federal governments should cooperate by agreeing generally on standards for employing, assigning, and compensating these personnel on the basis of their certified capabilities. This latter thought does not imply government control of the engineering profession.

"Minimum national standards should be determined and kept current by persons who are able to stay abreast of the current technological stampede . . ."

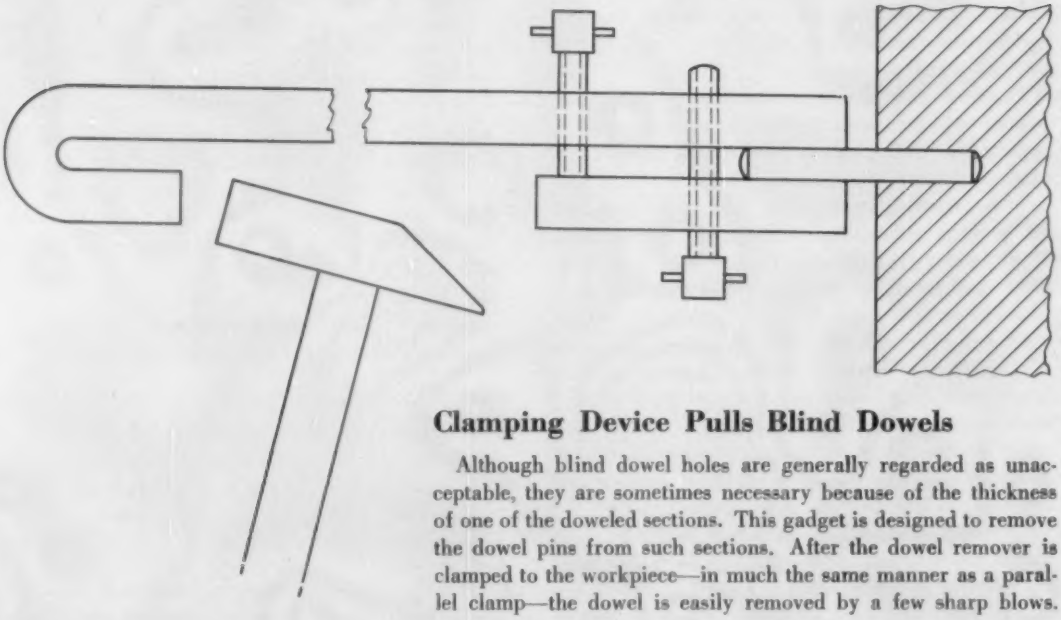
Further, all professional engineers and engineering technicians should be re-examined periodically to insure they have not lost their skill or are not falling too far behind critical developments in their areas of professional or special interests. Those who do not practice for a selected period of time should be placed in an inactive status, and remain there until they can establish their competency to again practice. For purely political reasons, administration and certification of compliance with these national standards should remain the prerogatives of the separate states. But in no circumstances should any local prejudices or biases be permitted to impose obstacles in the progress of engineering.

The benefits of these proposals may be many. The foremost benefit, however, will be to raise the level of engineering competence in this country. And without greater engineering competence, America's role in the Space Age may be small.

Gadgets

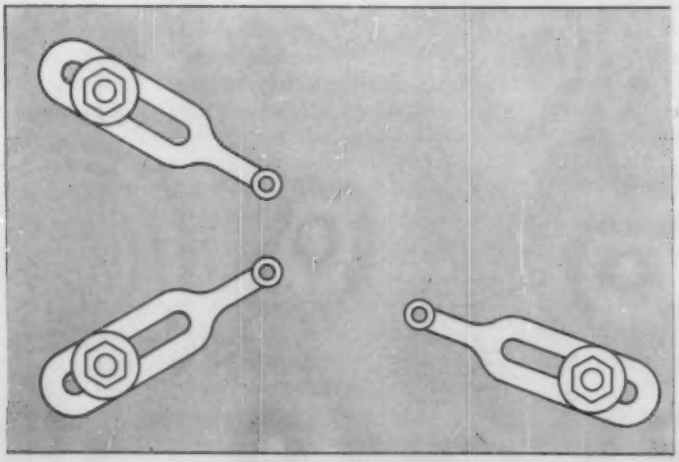
Ingenious Devices And Ideas

In this issue of TME we are presenting a selection of gadgets submitted by Federico Strasser of Santiago, Chile. All of the gadgets—picked from a total of 68 submitted—have been developed by Strasser for use in the toolroom of his electrical-parts manufacturing firm. Since they're all pretty good, we're letting Mr. Strasser have the run of this department for a month.



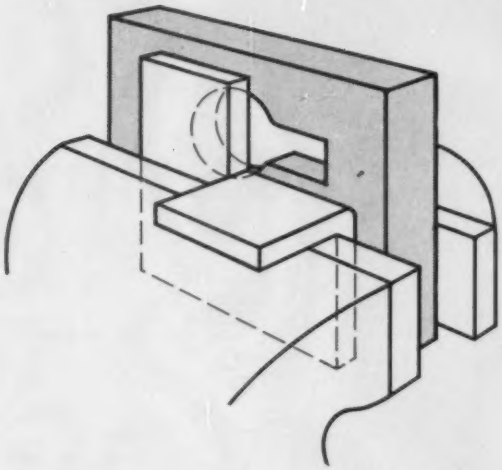
Clamping Device Pulls Blind Dowels

Although blind dowel holes are generally regarded as unacceptable, they are sometimes necessary because of the thickness of one of the doweled sections. This gadget is designed to remove the dowel pins from such sections. After the dowel remover is clamped to the workpiece—in much the same manner as a parallel clamp—the dowel is easily removed by a few sharp blows.



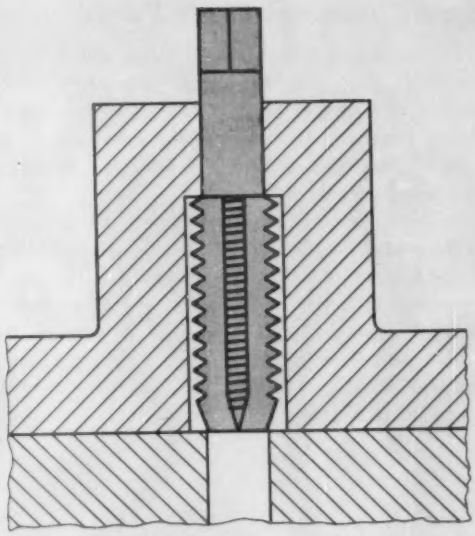
Die Buttons Double as Drill Bushings

Drill presses—instead of lathes and milling machines—can be used for accurate hole machining with buttons of this design. The "buttons" are actually drill bushings mounted in adjustable clamps. Positioning is accomplished just as it is with conventional buttons but the usual indicating or workpiece positioning is eliminated.



Vise Jaw Protects Finished Surfaces

This guard serves two useful purposes in that it protects the face of a die section from abrasion by the vise jaw, and it protects finished interior surfaces from careless file handling. Fabrication of the guard is easily accomplished by sawing part way through a piece of sheet metal and bending one of the resulting leaves to 90 deg.



Tap Guide Insures Alignment

This tool is designed to provide taps with correct vertical alignment at the beginning of a manual tapping operation. In use, the operator holds the guide in position with one hand and starts the tap with the other. After the tap is well established in a vertical path, the guide is removed and the operation is finished conventionally.

GADGETS CONTEST: October 1 to Dec. 31

We hate to mention the fact that summer's drawing to a close . . . but it is and October 1 is just around the corner. This can only mean that from now on a great deal of your time is going to be spent in putting on storm windows, giving the lawn its final fall manicuring and driving through impossible traffic to the football stadium.

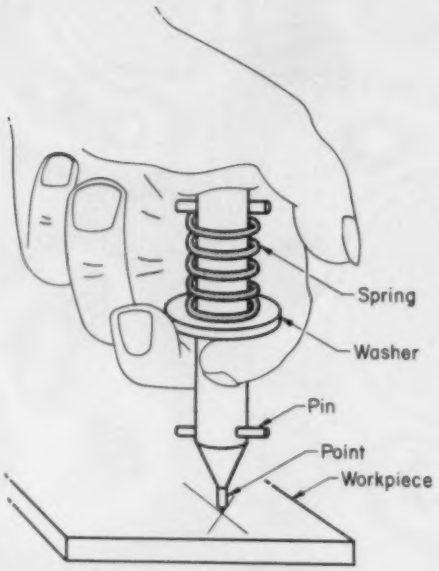
Before you get caught up in the autumnal rush to winter, why not jot down and send in that gadget idea of yours—the one you've mentally filed away for the Gadgets Contest? Here are the rules:

- **Contest is open to ASTME members only**
- **Entries must be limited to 500 words**
- **Sketches in lieu of finished drawings will be accepted**
- **Entries will be judged by the National Editorial Committee on the basis of originality, conciseness and completeness of presentation**
- **Prizes: First prize, $100; two second prizes of $50; four third prizes of $25; and honorable mention awards to all close runners-up.**

Spring Actuates Prick Punch

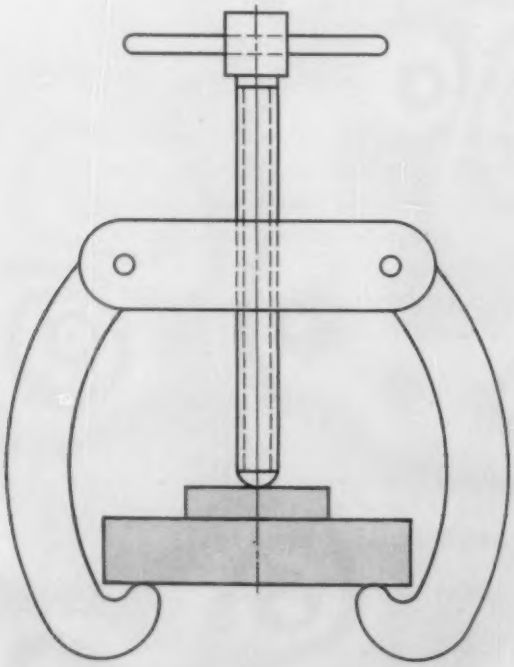
Designed to minimize or eliminate punch errors resulting from hammer blows, this prick punch utilizes two springs and a washer to provide required pressure. The point of the punch should be a replaceable unit such as a phonograph needle or sharpened carbide insert.

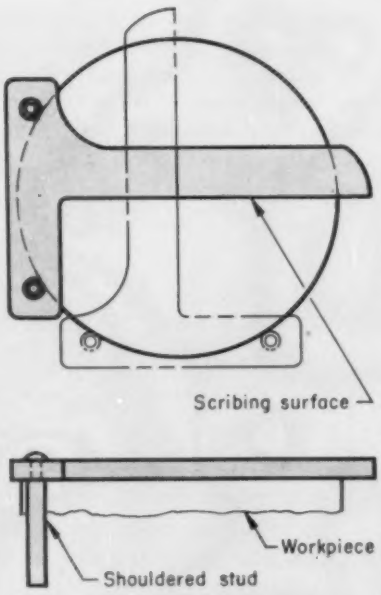
To obtain accurate punch indentations, the point of the punch is carefully positioned at the juncture of the intersecting lines. The body of the punch is supported in a vertical position and the washer is elevated against spring pressure. Release of the washer and its subsequent contact with the lower pin provides the shock required to make a deep indentation in the workpiece.



Pocket-Size Center Finder (Right)

Made with the same purpose and essentially the same geometry as a conventional centerhead, this tool has the additional virtue of being easy to carry around. Like the centerhead, it is used to scribe two lines, approximately 90 deg apart, on the ends of cylindrical parts. The intersection of the lines indicates a center. Accuracy of the tool depends on making the scribing surface perpendicular to, and through the center of, the line connecting the centers of the shouldered studs.





Clamp Simplifies Scribing (Left)

Designed to eliminate the interference caused by clamps during scribing operations, this device is useful in transferring punch or template outlines to strippers and die blocks. It is also useful in applications in which the difference in size of the clamped parts precludes the use of conventional C-clamps or other clamping operations.

solving problems in GEAR DESIGN with computers

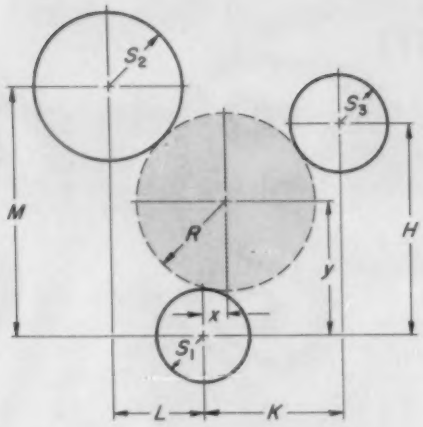
Fig. 1. Head for a trunnion machine. Fifteen computer calculations were required in completing its design.

By Kurt O. Teeh
Vice President-Engineering
The Cross Co.
Detroit, Mich.

Using a general-purpose computer to solve specialized engineering problems is a practical way to increase both computer and engineering efficiency. This article describes The Cross Co.'s experience in adapting their computer to the solution of problems in gear design.

FINDING the size and location of a gear that meshes with three known random gears is one of the more difficult problems encountered by gear designers. Normally this job is accomplished by laying out the gear, determining its dimensions graphically and substituting these dimensions in a series of equations involving seven variables. Final evaluation of three unknowns usually takes about two hours using a desk calculator.

One company, The Cross Co. in Detroit, has eliminated this expenditure of engineering time by establishing a programming system that makes it possible to feed gear design problems into a general-purpose computer. This has greatly increased engineering efficiency in the manufacture of multiple-spindle machining heads, *Fig.* 1, and it has eliminated the errors that often occur in desk-computer calculations. It has also eliminated the



S_1	S_2	S_3	H	K	L	M	x	y	R

Fig. 2. Typical problem in gear designing. Variables are listed in the left-hand boxes. From these the computer solves for *X*, *Y* and *R*.

need for checking the results obtained by way of empirical equations. Although checking does not require an excessive amount of time, it is an important factor when the total number of gear problems solved is taken into account. In addition, it is another source of human error.

Before the computer could be used for solving gear problems, it was necessary to set up four program boards, a job requiring approximately three weeks. These were designed to include an automatic check on the solutions obtained.

In use, original data, represented by S_1, S_2, S_3, H, K, L and M, Fig. 2, are punched on a card. This card is then used to present the problem to the computer. As part of the solution, the computer transfers the original values to the answer card and in this way the operator is assured that the machine has solved the correct problem. As a double check, the computer then calculates two of the original values from the answers it has obtained. These answers show the accuracy with which the original problem has been worked.

The general-purpose computer has proved so efficient in this respect that Cross has programmed it to solve the comparatively easy problem of the gear that meshes with only two other gears, each of which is known. Only four variables—requiring two program boards—are involved in this problem. Time requirements for both types of problem are approximately the same, however.

Since establishment of these techniques at Cross, gear design has been reduced to a relatively simple procedure. The design engineer lays out his spindles to conform to the requirements of the workpiece, selecting gear sizes that will provide correct rotational speeds. He then inspects the layout to determine the number of calculations required and fills in the forms with the values representing the centers and radii of known gears. These forms are delivered to the data processing department and, if the computer is open, the answers are returned to the engineering department in less than 15 minutes.

When multiple-spindle heads are designed, a series of problems involving two and three gears is set up and solved successively. The designer takes the answers from the first set of problems and combines them to set up the next round. In these cases, he goes to the data processing department to eliminate the time involved in information transfer.

Special-purpose computers would be more directly applicable to solving problems of this type and would eliminate the program setup time. However, the approach outlined is a good one for companies that use general-purpose computers for other purposes but do not have large enough engineering loads to justify the purchase of special-purpose computers. Results obtained by the latter computers would be no better than those now obtained.

Flexible Monitors for Industrial TV

A new series of closed circuit television monitors intended to fill the varied visual communication needs of industrial plants has been developed by General Electric Co. An expanded brightness range fits the monitors for operation in areas of high ambient light. Because of this electronic advance, GE has made available an accessory polarized safety glass faceplate for additional effectiveness in minimizing reflections and improving contrast ratio. Functioning with three times the picture quality of standard home sets, the monitors operate with standard monochrome cameras.

The monitors are equipped with a new type of input circuit that cancels out picture disturbance caused by surrounding high-current wires. This insures maximum consistency of picture quality, particularly around high-power electrical machinery.

Another advanced design feature prevents interaction of controls. This enables the operator to control size, focus and linearity on the monitor without having adjustments of one function affect adjustments of another.

numerical control's NEW LOOK

By T. W. Black / Senior Associate Editor

Numerical control has been a production reality for nearly 10 years. Each of those years has brought forth better control systems and advances in control technique. And each of those years has also brought new applications of numerical control to metalcutting, to assembly and to inspection operations. In the following pages, some truly important developments are described — developments that should hasten the broader application of numerical control and lead to major savings in time and money for American industry in both military and commercial work. Two programming systems — Autopromt and Waldo—make it possible for manufacturing engineers to program complex three-dimensional milling jobs quickly, relying on computers for the thousands of individual calculations necessary to determine cutter paths. And a new numerically controlled inspection machine is proving that the savings possible with automatic inspection can be of the same order of magnitude as the savings through numerical control of machining operations. Although not every company may have a place for numerical control this year or next, its wide adoption is inevitable. The articles in the following pages illustrate the present state of the art and presage some exciting future developments in metalcutting and measurement.

numerical control's new look

automatic programming
—pays off for complex work

YOU don't have to be a mathematical genius or a human calculating machine to program complex three-dimensional milling jobs. Here's how the computer takes over in a new programming system that saves hundreds of engineering hours.

NUMERICALLY CONTROLLED MACHINING has been a reality for nearly 10 years. During that period, numerical control has grown from the experimental stage to a widely applied production tool—a tool that is saving millions of dollars annually. So far as three-dimensional milling is concerned, this rapid development has been made possible by advances in computer programming. The first numerically controlled machine tool, an experimental three-axis machine, was demonstrated in 1952 at MIT. This tool could only be programmed by manual methods. Programming required an engineer with a desk calculator who laboriously computed the coordinates for each tool position in order to cut a curving path. Where fine tolerances were desired, hundreds of tool positions might have to be calculated for only a few inches of cutting path.

By early 1954, MIT was demonstrating the use of a computer to generate the numbers for a cutting program. A computer subroutine was developed for each type of curve to be cut. A library of subroutines was built for programming such cuts as lines, circles and ellipses.

Advanced as this system was, it still required an experienced programmer to patch the various subroutines together into a special computer program that would generate the required machine tool cutting program. Lengthy manual calculations were required for special cutting paths, such as milling a fillet surface in a complex part.

Fig. 1. Numerically controlled machine tool cuts surface of helicopter gearbox cover—the first practical shop job run under control of a tape produced by a new programming system.

MIT tried another approach later in 1954, based on the newly developed technique of automatic programming. The result, in 1955, was a program in which the existing library of subroutines was stored in the computer's memory and referred to automatically by the computer while generating a cutter path. The program to describe a cutting path was a set of special codes that became commands to the computer for generating each separate line or curve of a tool path.

The programmer was no longer required to understand how the computer worked. But he still had to describe the tool path numerically—a complicated procedure. This type of programming represented a distinct advance, however, and many numerical control programming systems in use today are based on this prototype.

The automatic programming concept used at MIT evolved into a program called "APT" (Automatic Programming of Tools), developed by the Aircraft Industries Association. The purpose of APT was to reduce still further the human effort required for generating tool positions for a cutting path. With this program, any desired cutting path can be written in an English-like vocabulary. Under control of the APT master program, a computer first translates the statements into the code required for instructions to the computer itself. Then the computer acts upon those instructions to generate the program of tool positions for the required cutting path. In other words, with APT, the computer transforms an English-like program into a numerical control program, thus solving a major problem in man-to-machine communications and paving the way for much wider use of numerically controlled milling machines. APT was made available commercially in 1959.

The Aircraft Industries Association has continued developmental work on APT and a number of aerospace firms have joined the project. The APT program has gone through several developmental stages. A single programming group has been set up by AIA to further expand the capabilities of the APT system for tomorrow's production.

Computer Understands English

The latest development in the field of programming for numerical control is the Autopromt system, developed by the IBM Mathematics and Applications Dept., with the cooperation of the Research Laboratories of United Aircraft Corp. This system has an automatic tool-path generation feature. The programmer writes out a few English-like statements that define an entire cutting region composed of one or more constituent surfaces. Then the computer automatically generates an efficient set of cutting paths for the entire region, maintaining the specific inside and outside tolerances without further burden on the programmer.

Results with the new system have been spectacular. The first part produced with Autopromt was a gearbox cover, *Fig.* 1, for turbine-powered helicopters. The portion of the gearbox cover programmed by Autopromt for numerically controlled contouring is a shallow, inverted cone about 38 inches in diameter. Its surface is broken by ten identical ribs extending from the center of the cone to the rim. The program produces numerical instructions for milling a single segment. The process is repeated ten times to mill the entire surface.

In conventional operations, with a machine operator working directly from blueprints, lead time from blueprint to production of the gearbox cover was about three months. Using Autopromt on an experimental basis, lead time was reduced to about four weeks, with one week devoted to writing the

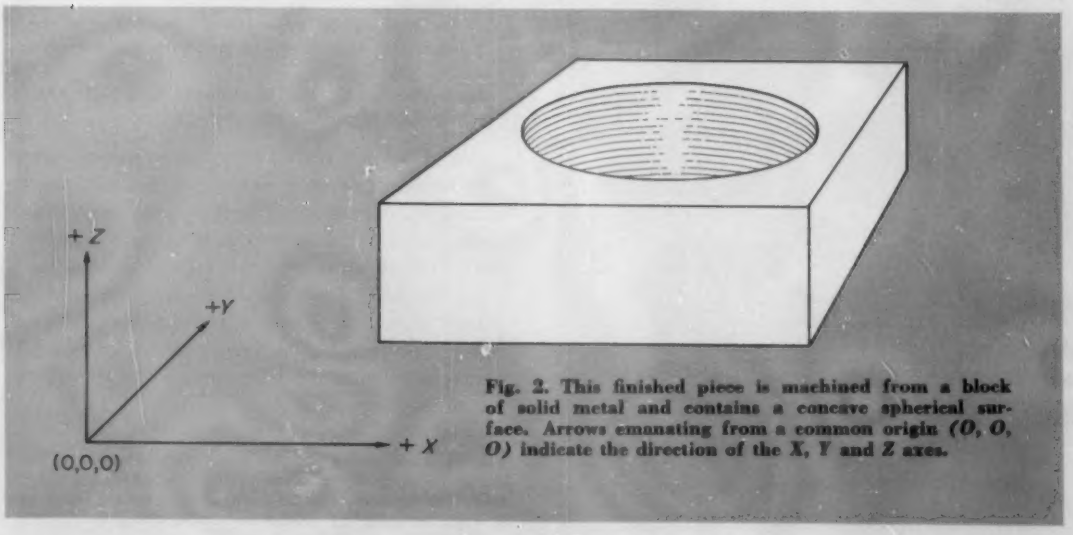


Fig. 2. This finished piece is machined from a block of solid metal and contains a concave spherical surface. Arrows emanating from a common origin *(O, O, O)* indicate the direction of the *X, Y* and *Z* axes.

input for the program and three weeks for running the program on the computer and correcting errors in the input. In normal operation, lead time is expected to be only two weeks for a part of similar complexity.

Actual milling of each part required approximately 150 hours with conventional methods. Using a Pratt & Whitney Numeric-Keller directed by the output of the Autopromt program, about 40 hours of machining time were required.

In programming, 180 one-line statements in the Autopromt language were written to describe the part completely. An IBM 7090 computer, using this information and controlled by the Autopromt master program, generated more than 8000 tool path instructions that were converted from magnetic tape form to perforated tape form to run the milling machine.

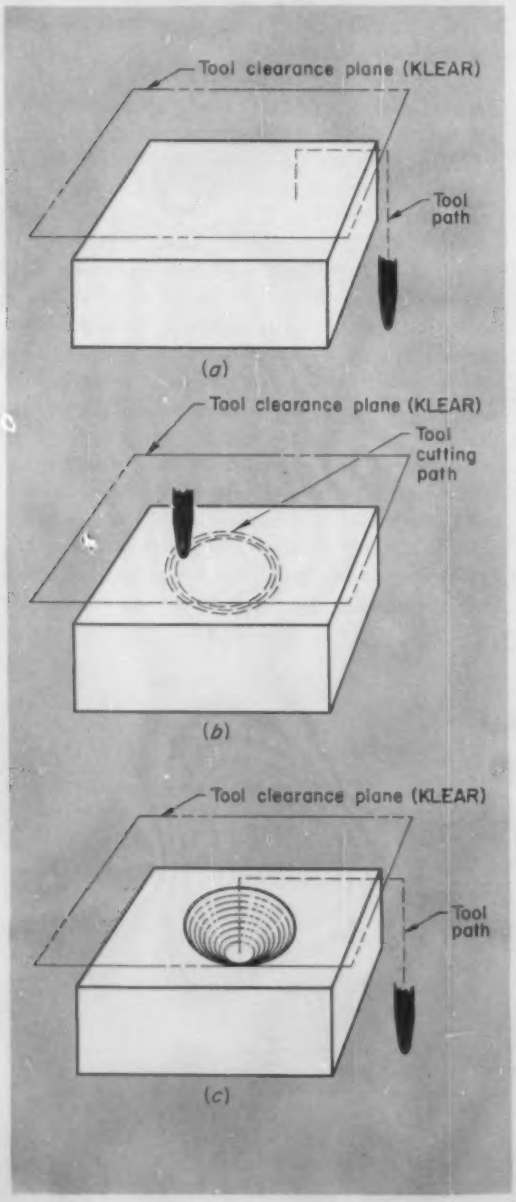


Fig. 3. Tool paths for machining sample part. Tool starts from position shown in drawing *a*, machines spiral to produce concave spherical surface, drawing *b*, then returns to initial point, drawing *c*.

How the System Works

The major objective of Autopromt programming is to eliminate the problem of translating blueprint data of three-dimensional shapes into the numerical control codes that direct the machine tool—work that ordinarily requires time-consuming calculations. The new system does not eliminate these calculations. With the aid of a computer, however, it all but eliminates the human time element required. Practically no preliminary calculations are required other than those available from the blueprint.

The programmer need only state the blueprint data in a form governed by the vocabulary and "grammatical" rules of Autopromt and state certain machine tool characteristics and procedures.

The work of the programmer can best be illustrated by a simple example—the workpiece shown in *Fig.* 2. A numerically controlled milling machine can produce this workpiece when the following items are provided:

1. The path that the tool must travel to make initial contact with a specific point on the part to be machined, *Fig.* 3*a*.
2. The tool cutting path (comprising many connected points) to be followed in producing the desired surface, *Fig.* 3*b*.
3. The path of the tool in returning to a point after it has finished cutting, *Fig.* 3*c*.

All of these items have one thing in common—points. The difference is that the calculations required for the tool cutting path are many times more complex and numerous than for the path of the tool to or away from the area of the cut. Each point on the tool path must be computed and recorded on tape or cards to instruct the numerical control equipment. The data required for computing these points is available from a blueprint drawing of the shape, *Fig.* 4.

Computing the points of the path that the tool must travel to make initial contact, *Fig.* 3*a*, requires three items of information—the coordinates of the point of the tool tip's initial position, a clearance plane through which the tool may travel when moving from its original position to its initial contact point, and the coordinates of the point on the metal block where initial contact is to be made.

Calculating the path that the tool takes to form the shape, *Fig.* 3*b*, requires eight items of information—the type of surface to be machined (in this case spherical and concave); the circumference of the circle that forms the edge between the flat top surface and the hollow; the curvature of surface (this is given indirectly by the radius of the sphere); the depth of the inside sphere; the radius of the cutting tool; the tolerances required; the general type of tool path and its direction; and information not directly related to the tool path, including the feed rate of the tool and when the coolant should be turned on.

The information required to return the tool to its initial position after the cut is made, *Fig.* 3*c*, consists of the coordinates of the point where the tool should return. Other information required at the conclusion of the operation includes instructions to stop the coolant flow and the machine tool.

For the purposes of this discussion, the state-

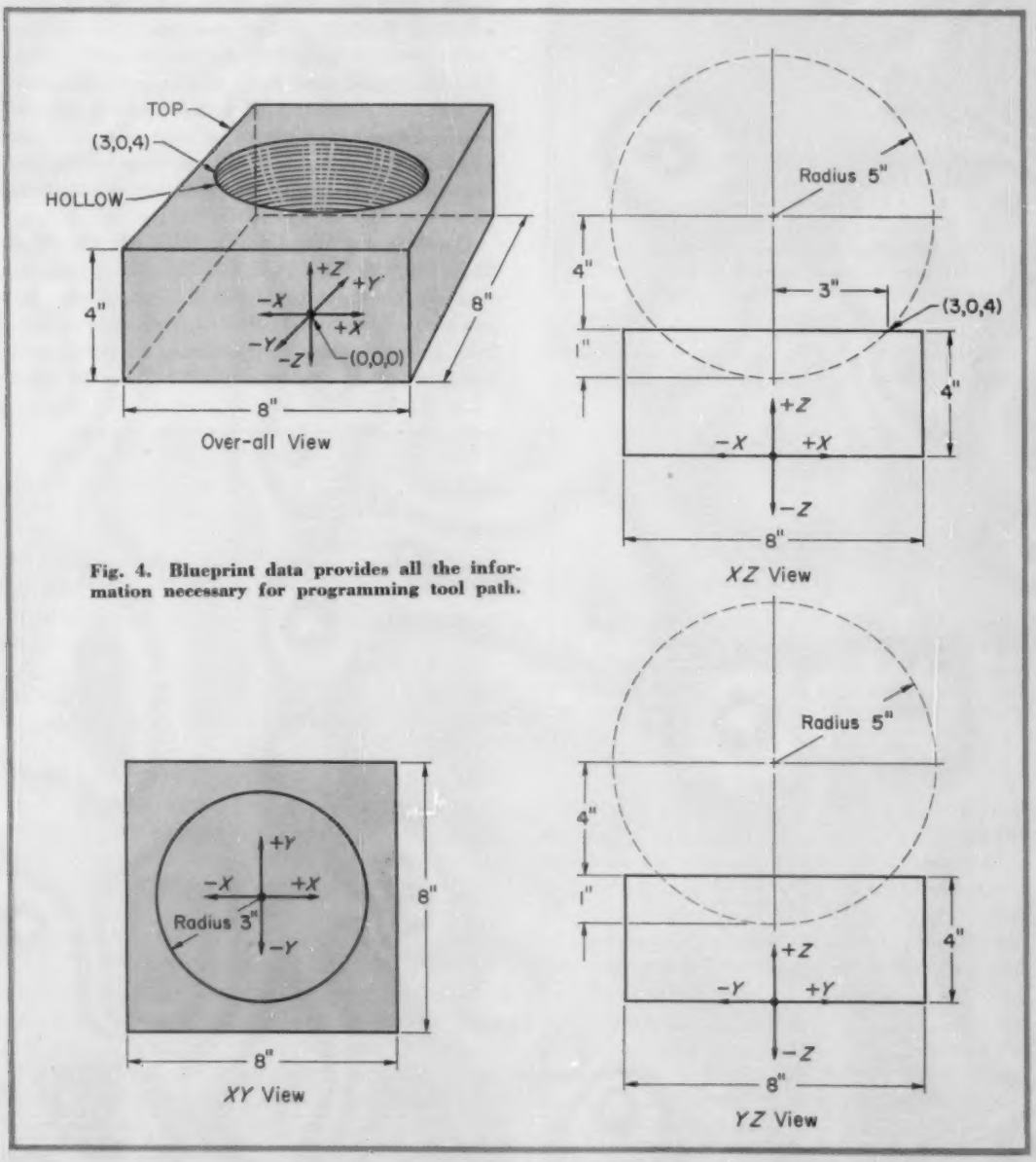


Fig. 4. Blueprint data provides all the information necessary for programming tool path.

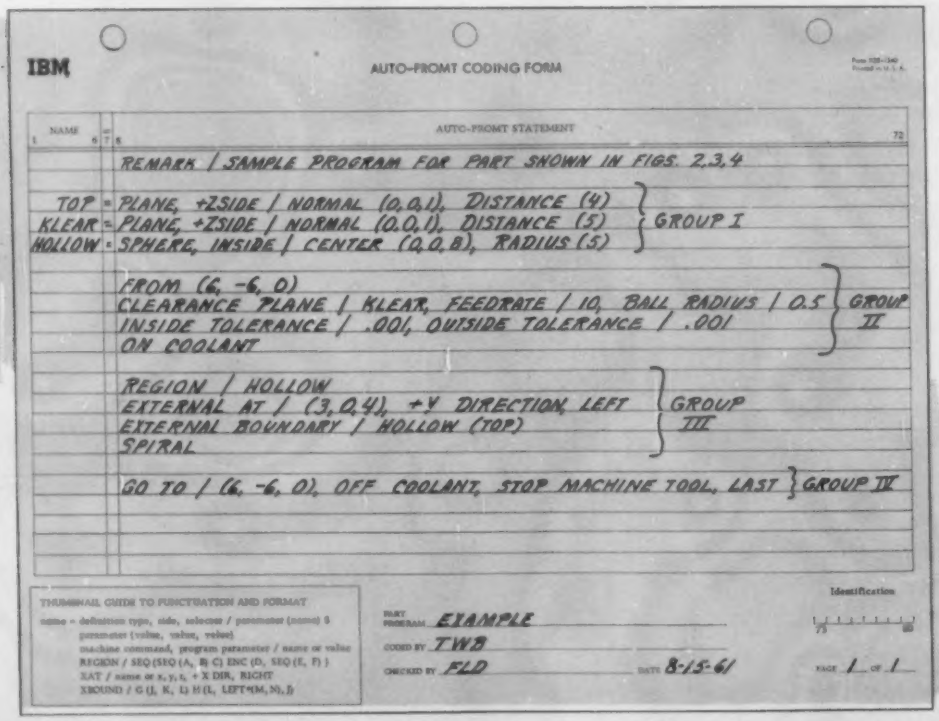
ments in an Autopromt program are divided into four categories:

1. Those statements that describe the surfaces considered in the machining plan.
2. "Initializing" information. Included are the tool's initial position, the description of a plane through which the tool can safely travel during noncutting operations, the feed rate of the tool in inches per minute, and miscellaneous actions to be executed before the cutting of metal begins, such as turning on the coolant. Also included are factors that must be considered in all tool path computations—the amount of error that can be tolerated and the radius of the cutting tool.
3. Basic information for computing the tool path—the name of the surface to be produced, a point on the boundary of the area to be machined, the direction in which to proceed in mapping out the boundary and where (right or left) the surface to be machined lies in relation to the boundary. Following this are the names of the surfaces that form the boundary and, last, the machining mode (in this case, spiral).
4. Conclusion of the program. This includes the point at which the tool's tip should come to rest after finishing its last pass, commands to turn off the coolant pump, and instructions to turn off the machine tool and the numerical control equipment.

The shape shown in *Figs.* 2, 3 and 4 has one machined surface, which can be produced with one tool pass. The Autopromt program shown in *Fig.* 5 covers the entire machining operation. The first statement—TOP = PLANE, +ZSIDE/NORMAL (0, 0, 1), DISTANCE (4)—defines the top of the metal block (called TOP) as being a plane (PLANE) whose upper face (+ZSIDE) is to be considered. Further, this plane is perpendicular (NORMAL) to the *Z* axis (0,0,1) at a distance (DISTANCE) of four inches (4) from the point of origin. As shown in *Fig.* 4, a point in the center of the bottom surface of the block has been selected as the origin from which all distances will be measured.

The second statement defines another plane, KLEAR, in the same fashion. The only difference in the two statements is the distance from the origin. Since KLEAR is to be used as a plane on which the tool can travel without encountering the workpiece, it is five inches from the origin (one inch above TOP).

The statement: HOLLOW = SPHERE, INSIDE/CENTER (0,0,8), RADIUS (5) indicates that another surface to be considered in the machining operation is spherical (SPHERE) and concave (INSIDE). Further, the entire sphere, of which only part is required, is centered (CENTER) at the point


IBM

AUTO-FROMT CODING FORM

NAME | AUTO-FROMT STATEMENT

REMARK / SAMPLE PROGRAM FOR PART SHOWN IN FIGS. 2,3,4

TOP = PLANE, +ZSIDE / NORMAL (0,0,1), DISTANCE (4)
KLEAR = PLANE, +ZSIDE / NORMAL (0,0,1), DISTANCE (5)
HOLLOW = SPHERE, INSIDE / CENTER (0,0,8), RADIUS (5)
} GROUP I

FROM (6, -6, 0)
CLEARANCE PLANE / KLEAR, FEEDRATE / 10, BALL RADIUS / 0.5
INSIDE TOLERANCE / .001, OUTSIDE TOLERANCE / .001
ON COOLANT
} GROUP II

REGION / HOLLOW
EXTERNAL AT / (3,0,4), +Y DIRECTION, LEFT
EXTERNAL BOUNDARY / HOLLOW (TOP)
SPIRAL
} GROUP III

GO TO / (6, -6, 0), OFF COOLANT, STOP MACHINE TOOL, LAST } GROUP IV

THUMBNAIL GUIDE TO PUNCTUATION AND FORMAT

name = definition type, side, selector / parameter (name) \$ parameter (value, value, value)
machine command, program parameter / name or value
REGION / SEQ (SEQ (A, B) C) ENC (D, SEQ (E, F))
XAT / name or x, y, z, + X DIR, RIGHT
XBOUND / G (J, K, L) H (L, LEFT+(M, N), J)

Identification

PART PROGRAM EXAMPLE
CODED BY TWB
CHECKED BY FLD
DATE 8-15-61
PAGE 1 OF 1

Fig. 5. Complete Autopromt program for machining the shape shown in *Figs.* 2, 3 and 4.

(0,0,8) and has a radius (RADIUS) of five inches (5).

In each of these statements an entire surface has been defined. In the case of the planes, they extend to infinity. The statements in Group III (*Fig.* 5) indicate the portions of the surface that make up the object being defined.

In Group II, the statement FROM (6,—6,0) indicates the original tool position. This is the point at which the tip of the tool should be lined up. CLEARANCE PLANE/KLEAR states that the clearance plane where the tool may safely travel during noncutting operations is the plane named KLEAR. The feed rate of 10 ipm is given by FEEDRATE/10 and the radius of the ball end tool is given as BALL RADIUS/0.5. The amount of error that can be tolerated is given by INSIDE TOLERANCE/.001, OUTSIDE TOLERANCE/.001. ON COOLANT is an action statement that will cause the coolant to be turned on at the proper time.

In Autopromt, an area that can be machined in one tool pass is called a "region." The first statement in Group III says that the region consists of one surface, HOLLOW. Going on, it is shown that a point on the external boundary of the area to be machined is (3,0,4). The direction to be taken in tracing out the boundary from (3,0,4) is in the positive *Y* direction. The region to be machined lies to the left of this direction. The external boundary in question is given by the third statement as the edge formed by HOLLOW and TOP. The final statement gives the machining mode as SPIRAL.

GO TO/(6,—6,0) specifies the point to which the tool's tip proceeds after completing its pass. OFF COOLANT turns off the coolant pump and STOP MACHINE TOOL turns off both the machine tool and the numerical control unit. The term LAST is included to indicate to the computer that no more computations are required.

This example of a complete program illustrates the ease with which the system can be used. As the shapes and machining procedures become more complex, *Fig.* 6, so do the statements. In practice, several rough cuts may be required before the finish cut is made. Further, the object to be machined may comprise several regions, each of which must be machined in a separate tool pass.

Many types of errors that could occur in the part description are automatically caught by the computer. For further verification, a printed list of coordinates for each tool position is prepared by the computer. These positions can be read or plotted to enable the programmer to visualize the tool path before the part is produced in metal. This ability to check the program before machining virtually eliminates the possibility of producing scrap parts due to faulty programming.

Automatic programming systems like Autopromt will have effects on metalworking that go far beyond faster machining. Because complex parts can be produced economically—and automatically—on a fast, short-run basis, parts for a development model can be produced in a form much closer to that planned for production models. As a result, the entire development and production cycle can be speeded up in critical areas such as missile manufacture. And with automatic programming, the need for highly specialized types of milling machines for certain types of parts is eliminated. Standard machines, made "special" by suitable machining programs, may be the rule in new tooling-up programs throughout industry in the near future.

Fig. 6. Saddle-shaped piece—a portion of a geometric shape called a hyperbolic paraboloid—was rough machined from a raw aluminum block under numerical control. Tape was produced automatically.

numerical control's new look

automatic inspection

—*the machine does it all*

PARTS that take hundreds of hours to inspect manually are being checked in two hours by a new tape controlled machine that prints out a record of all measurements.

NUMERICAL CONTROL can save weeks of lead time and hundreds of hours of machining time in the milling of complex, high-precision three-dimensional parts. These advantages are attractive to the American metalworking industry, of course. Surprisingly, numerically controlled inspection, which can have an equal impact on manufacturing, has not been so widely applied. One of the reasons for this lag has been the fact that control builders have concentrated on machining applications. Another is that numerically controlled inspection is a new concept, requiring a new type of inspection machine. Several manufacturers have been working to fill this need.

The most recent—and in some ways the most advanced—of the tape-controlled inspection machines is The Sheffield Corporation's massive five-axis measuring machine, which will initially be used for the inspection of spacecraft and armament components. Operating automatically from instructions coded on a tape, this machine, *Fig.* 1, measures and records internal and external dimensions, wall thicknesses and other geometrical conditions, and relationships of symmetrical objects such as cones, tubes, cylinders and hemispheres.

In size, in capacity and in performance, the machine represents a big step forward in metrology. Weighing 16 tons, it can accommodate parts up to 20 inches high and 20 inches in diameter. Minimum inside diameter is two inches. The machine will measure any point or angle within the 20-inch gaging range to an accuracy of one ten-thousandth of an inch. Over this range, repeatability is within plus or minus five-millionths of an inch. Wall thickness is measured to an accuracy of fifty-millionths of an inch. All slides, vertical and horizontal, operate within fifteen-millionths of an inch of true position and accuracy of positioning can be calibrated within ten-millionths of an inch of an established master.

The general design of the machine is evident from *Fig.* 2. The part to be gaged is mounted on the machine's rotary table with its longitudinal axis vertical and coincident with the axis of table rotation. Two slide-mounted rotating ball gage cartridges are the sensing elements. These are connected to electronic amplifiers. In operation, one cartridge contacts the inner surface of the part and the other the outer surface.

The machine has five axes of controlled motion —vertical motion of the inside stylus, vertical motion of the outside stylus, horizontal motion of the outside stylus, horizontal motion of the worktable and rotary movement of the part.

The part's nominal dimensions, encoded in serial form on punched tape, are used as command signals for positioning the workpiece slide and the vertical slides carrying the gage cartridges. With the cartridges positioned for a given horizontal plane, the part is rotated about its vertical axis, either in controlled steps or continuously. Deviations from the nominal dimensions are printed out in tabular form as well as visually indicated for various points on the plane. The number of planes, as well as the number of points of inspection, depends on the part specifications.

Programming is simple. Working from the specifications of the part to be gaged, the gage programmer develops a process sheet listing the X and Y positions of all the points to be checked. This data is fed into a Flexowriter machine that produces a standard, eight-channel, one-inch-wide control tape. In operation, a Bendix numerical control reads

Fig. 1. (above) Five-axis measuring machine. Commands on punched tape being held by the machine operator tell the machine to automatically measure and point out millionths-of-an-inch size deviations in workpiece. Plastic bubble on machine table is simulated workpiece—a missile part.

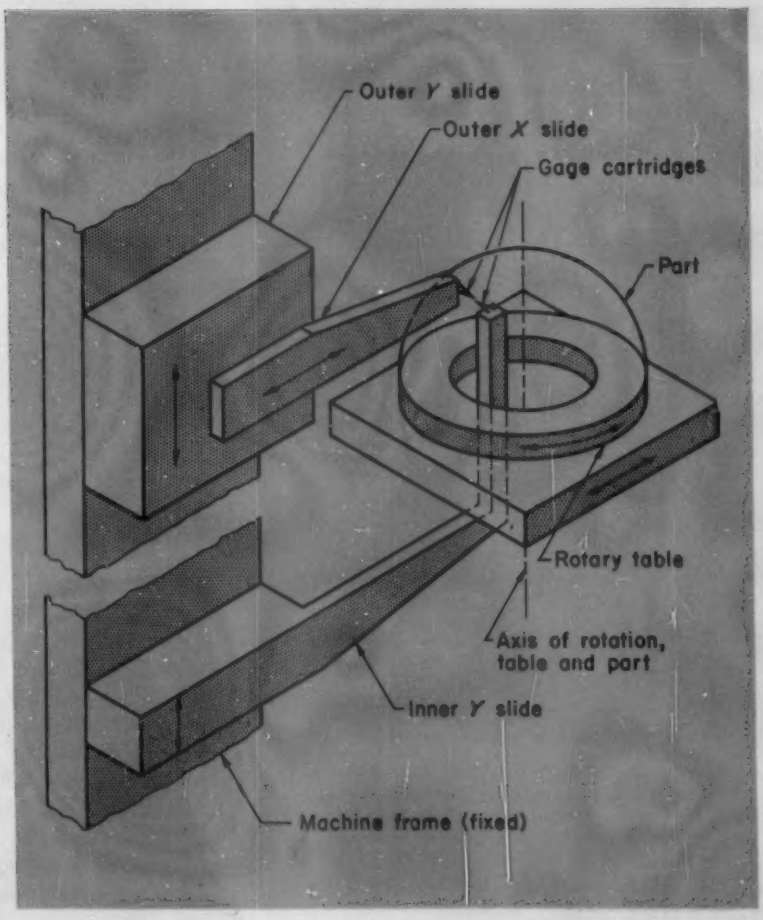


Fig. 2. (right) Axes of movement of tape-controlled measuring machine. Normal rate of travel of slides is 40 ipm.

the tape and executes each command.

The command may be to move a slide a specific amount, rotate the table, or to perform whatever auxiliary functions are required for over-all gage performance. With the gaging cartridges in position, the tape also initiates the gage readout cycle. Deviations from nominal size detected by the cartridges are fed into an analog-to-digital converter and the data printed out in tabular form on 15-inch-wide paper, *Fig.* 3. Visual indications of size deviations are shown on an amplifier in the gage console. The machine automatically computes the algebraic difference between opposed gage points on the internal and external surfaces, thus giving a direct reading of wall thickness.

Fig. 3. Size deviations of workpiece are printed out here. Up to 100,000 readings can be made in a single inch.

Since the machine can gage any angle or point within opposite 90-deg quadrants, it can perform inspection operations impossible or uneconomical to perform with conventional methods. An example is inspection of the hemispherical part shown on the machine in *Figs.* 1 and 3. A point of inspection is specified at every two degrees of latitude and every 60 degrees of longitude for outside contour, inside contour and wall thickness. Some 795 gage readings, including 265 mathematical computations for wall thickness, are required.

The measuring machine can complete the inspection and provide a printed record of all data in approximately two hours. If conventional methods were used, inspection would require 125 hours and the changing conditions encountered in using a surface plate, rotary table and height gage, plus the human element, make it unlikely that the measurements would be completely reliable. Temperature changes alone during the 125-hour inspection period could radically influence the results obtained.

Three modes of gaging are possible with the machine. In numerically controlled scan gaging, the part is rotated slowly. Any dimensional deviation exceeding preset limits causes the rotation to stop. The position and excessive deviation are printed out. The table then rotates a preset amount, stops and, if deviation is still excessive, position and deviation are again printed out. This sequence provides automatic point-by-point inspection and recording on a plane. The stop-record-start sequence continues until the gage indicates the deviation is within the allowable limits, at which point scanning resumes.

In a second gaging mode, increment gaging, the rotary table, under tape control, advances a preset amount, stops, and deviation and position are printed out. Deviations within preset limits are printed in black; those outside the limits are printed in red.

In the third gaging mode, operator-controlled gaging, the operator can manually set up all of the conditions that would normally be included in tape command. Under operator control, parts of unknown dimensions can be explored and slide positions printed out. The information obtained in this manner then becomes the manuscript tape for reproducing the part.

The characteristics of the new machine—extreme accuracy, versatility and speed—conclusively demonstrate the benefits of numerical control when applied to gaging. Within a few years, numerically controlled gaging machines may be as widely applied as numerically controlled metalcutting machines. The necessary technology has already been developed as evidenced by the new machine.

numerical control's new look

automatic diesinking
—a success story

DIES with complex contours are being produced by numerically controlled machine tools on a routine basis. The advantages: shorter leadtime, shorter machining time, greater accuracy, less hand finishing. This development may revolutionize diemaking.

ELIMINATION of the need for costly die models and templates together with potentially faster machining time make numerical control particularly attractive for the production of complex forming dies, *Fig.* 1. Early work in this field, however, was not completely successful. Although existing control systems and machine tools were capable of producing forming dies to close tolerances and at high rates of speed, the time required to develop a machining program was often substantially longer than the time required to produce a die model. Further, because of human errors, the taped program often required corrections.

It was apparent that two things were needed to make numerically controlled diesinking economically feasible—a computer program capable of doing all of the calculations required for sinking irregular die shapes and some means of checking completed programs for errors before the start of actual metalcutting operations.

Many manufacturing engineers have tackled these two problems and, in a recent breakthrough, numerical control personnel of the Boeing Company's Wichita (Kan.) Div. proved that it is economically feasible to produce automotive forming dies under numerical control. In the Boeing system, computations are done using WALDO, a computer program for three-dimensional contouring work. To check the program before machining, the cutter center path on the control tape is plotted with an automatic universal drafting machine, *Fig.* 2, to produce a drawing that makes programming or computer errors visible, *Fig.* 3. Both of these developments represent a big step forward in numerically controlled diesinking.

Programming: The first step in programming is to set up the sequence of machining commands required to generate the die. Programming engineers work from drawings that are completely dimensioned. Curves, for example, are actually dimensioned, rather than being merely faired in with a French curve.

Each of the commands occupies a line on the handwritten form shown in *Fig.* 4. The command instruction consists of a descriptive word (at left on the form) and associated numerical data. There are 35 of these five-letter words. They enable a parts programmer who has only high-school-level mathematics to completely program complex three-dimensional machining operations. The descriptive word tells the computer the general kind of computation to perform; the numerical data generally consists of the coordinates of a point on the workpiece surface and additional data describing conditions around the point—circle, inside corner, and so forth. For the oil pan die shown in *Fig.* 1, 544 such entries were required, involving about 24 man-hours of effort. Each of the entries is subsequently punched into a standard punched card. For proofreading, the deck of cards is run through a tabulator-printer, producing the typed form shown in the lower portion of *Fig.* 4. The information on the cards is put onto magnetic tape in a separate operation. The magnetic tape furnishes input information to an IBM 705 Model III computer.

Within the computer, the descriptive command word generates a series of detailed subcommands needed to complete the appropriate calculations. Herein lies the power of the computer program as a time-saving engineering tool. Each one-line entry

numerical control's new look

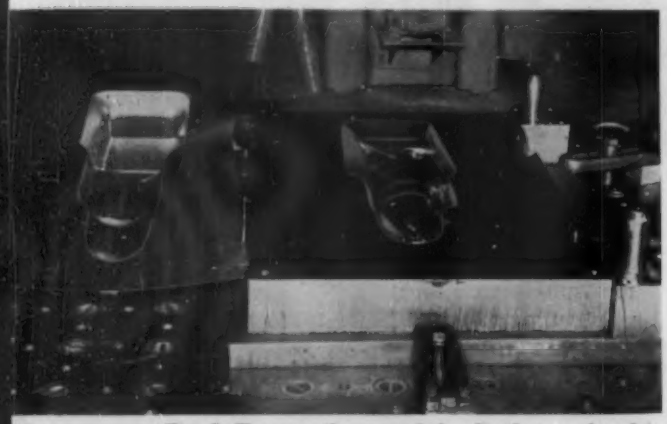


Fig. 1. Tractor oil pan and the die that produced it. The male and female dies were machined in 24 hours, using numerical control.

Fig. 2. Numerically controlled universal drafting machine makes drawings from taped instructions.

generates an average of 2000 computer calculations. From the 544 manuscript entries for the oil-pan die, 21,000 output points were calculated. To do this, the computer performed 189,000 trigonometric functions, 21,000 square root extractions and made 2 million errorless calculations. All this was done in 3.5 hours. The output points were produced as punched cards for subsequent handling.

Checking the Program: Reams of tabulated data could be checked by an engineer, but this is tedious and time-consuming and the numerical data is such that errors could pass unperceived. The plotter-verifier makes it possible to avoid these problems. Any two dimensions of a three-dimensional path are drawn automatically from the punched-card information produced by the computer. The two views of the oil pan die cutter path, *Fig.* 3, required 16 hours of plotting time on the drafting machine. Two mistakes in programming were revealed. That such mistakes can occur in planning is not unusual. The drawing demonstrates the value of the graphic presentation of computed results—errors are immediately evident. In this case, two data points were given to the computer as existing on the part surface when actually the plotted path reveals that the points lie outside the part surface.

Finding two such erroneous points in a long listing of tabulated points would be much more difficult than finding them in a drawing. Errors are corrected by changing the incorrect input cards and recalculating the affected portions of the cutter path. The corrected output cards are then substituted into the output deck and the deck run through a card-to-tape converter, producing a punched tape. This tape supplies the Bendix control system with

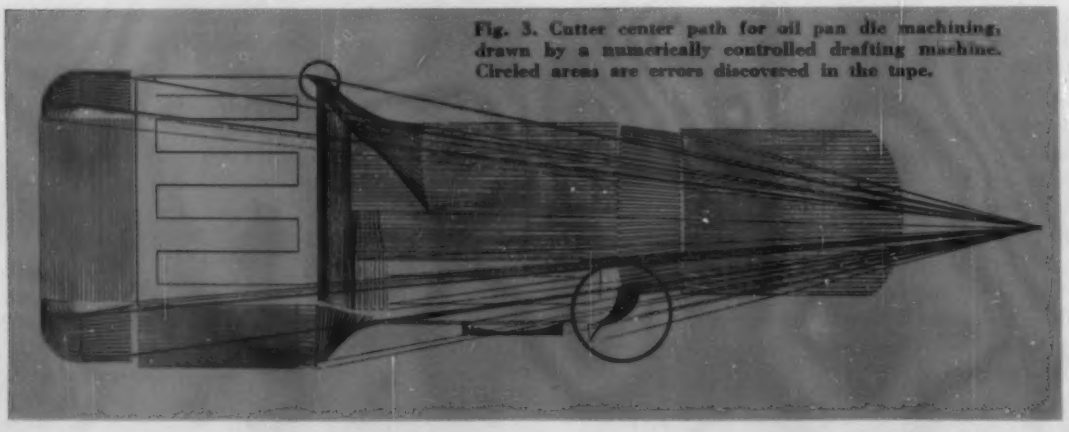
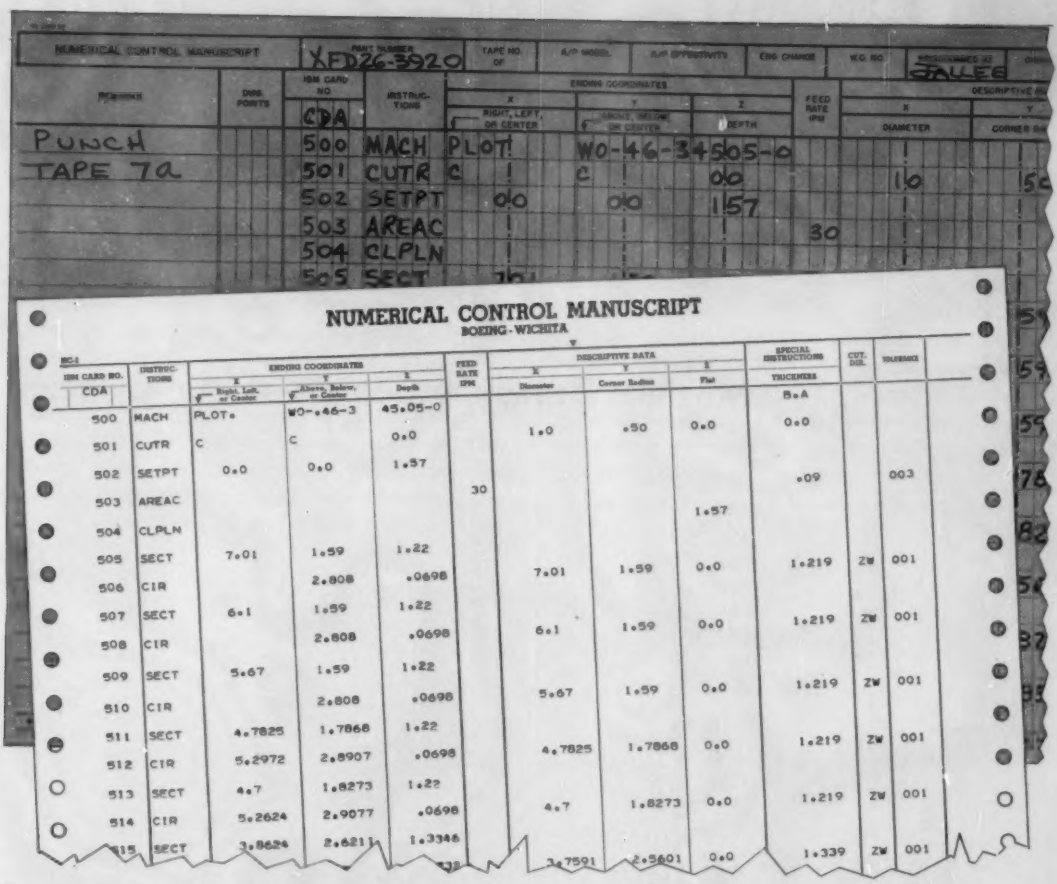


Fig. 3. Cutter center path for oil pan die machining, drawn by a numerically controlled drafting machine. Circled areas are errors discovered in the tape.



NUMERICAL CONTROL MANUSCRIPT

BOEING - WICHITA

SEQ.	ISN CARD NO. CDA	INSTRUCTIONS	ENDING COORDINATES X (Right, Left, or Center)	ENDING COORDINATES Y (Above, Below, or Center)	ENDING COORDINATES Z (Depth)	FEED RATE IPM	DESCRIPTIVE DATA X (Diameter)	DESCRIPTIVE DATA Y (Corner Radius)	DESCRIPTIVE DATA Z (Flat)	SPECIAL INSTRUCTIONS (Thickness)	CUT. DIR.	TOLERANCE
										B.A		
	500	MACH	PLOT.	W0-.46-3	45.05-0		1.0	.50	0.0	0.0		
	501	CUTR	C	C	0.0							
	502	SETPT	0.0	0.0	1.57					.09		003
	503	AREAC				30			1.57			
	504	CLPLN										
	505	SECT	7.01	1.59	1.22		7.01	1.59	0.0	1.219	ZW	001
	506	CIR		2.808	.0698							
	507	SECT	6.1	1.59	1.22		6.1	1.59	0.0	1.219	ZW	001
	508	CIR		2.808	.0698							
	509	SECT	5.67	1.59	1.22		5.67	1.59	0.0	1.219	ZW	001
	510	CIR		2.808	.0698							
	511	SECT	4.7825	1.7868	1.22		4.7825	1.7868	0.0	1.219	ZW	001
	512	CIR	5.2972	2.8907	.0698							
	513	SECT	4.7	1.8273	1.22		4.7	1.8273	0.0	1.219	ZW	001
	514	CIR	5.2624	2.9077	.0698							
	515	SECT	3.8624	2.6211	1.3348		3.7591	2.5601	0.0	1.339	ZW	001

Fig. 4. Some of the 544 instructions required to produce the oil pan die. Each one-line entry generates an average of 2000 computer calculations.

information to direct machining of the die. Machining of the male and female dies was completed in 24 hours. Since the contoured die surfaces were machined to 21,000 accurately calculated and checked points, the dies are more accurate than those produced by conventional means. Less barbering and handwork is required.

Conclusions: Not all workpieces are economically produced by numerically controlled diesinking. When standard procedure is to produce a clay model or plaster cast of the desired workpiece, and this cannot be avoided, there is little economic incentive to apply numerical control. Where product design changes are frequent, work materials tough and lead times are short, the resultant high rate of die change-over makes numerical control attractive. The repeatability of numerical control, its amenability to changes by simply changing cards in a deck, and its elimination of master models or templates are the source of major economics. In fact, the economies possible are causing revision of engineering thinking about the use of models, templates and similar means of information storage.

Gains possible with numerically controlled diesinking are easily measured. Machining time averages about half the time required by conventional methods. Gains in accuracy and savings in hand finishing are also distinct and measurable. Gains achievable in the ancillary and support functions of data handling are real, but difficult to measure. When computers are used in the product design stage, drawings can be eliminated or greatly simplified. Fixtures can be simple and economical. Much paperwork handling can be eliminated or simplified. Lead time is reduced.

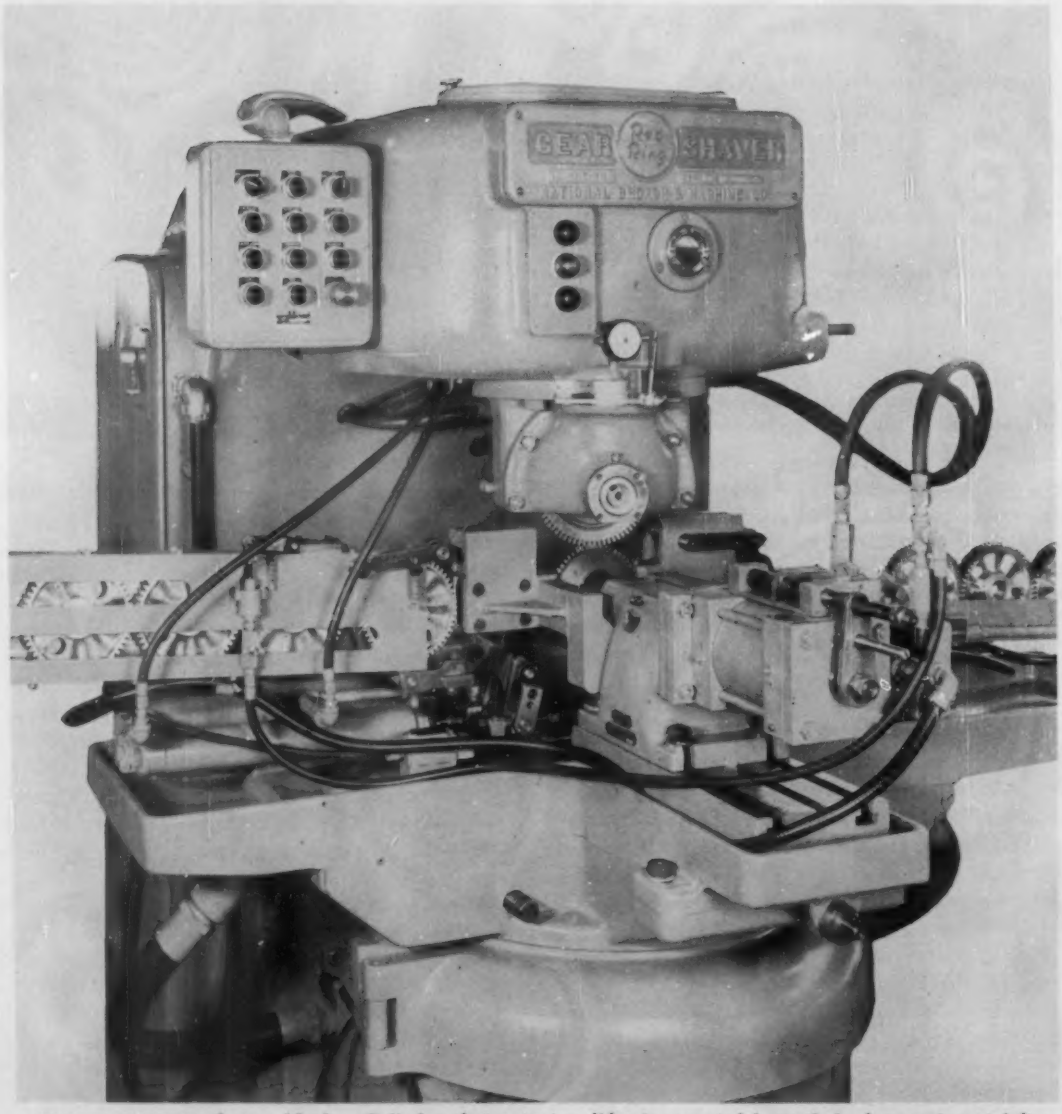
Also of importance is the fact that right-hand and left-hand dies are made with the same tape and, on dual-spindle machines, can be machined simultaneously.

Manufacturing performance is improved all along the line—from product design to the finished die—by the use of numerical control. Thus, total realizable gains considerably exceed the first-sight gains in machining and fixturing and rerunning die machining jobs. This will outweigh other considerations and increase the use of numerical control for diemaking for all work except where data exists in some accessible analog or model form.

designed for

PRODUCTION

Machine Transfers Gears with Air Cylinders



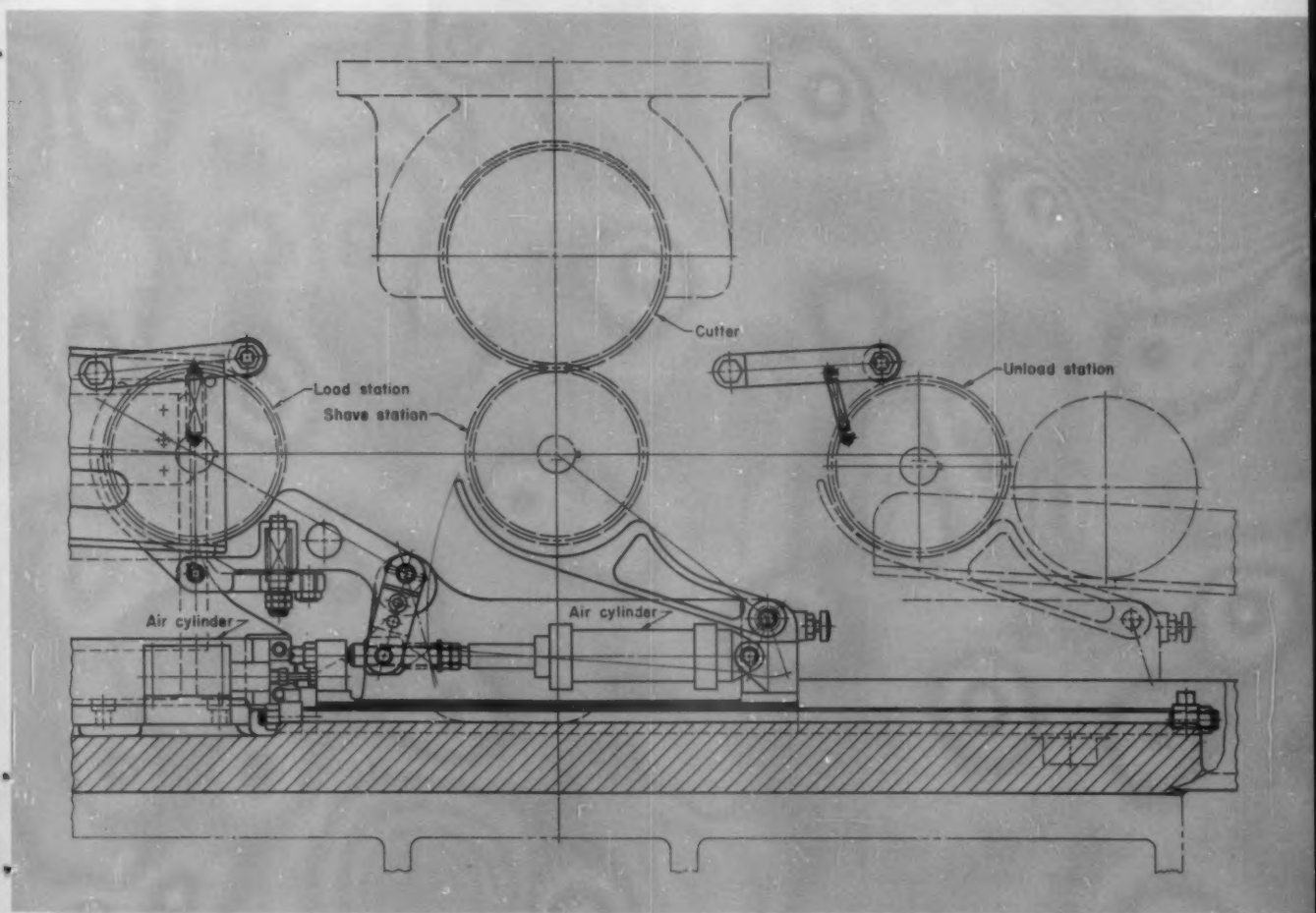
IN-LINE TRANSFER of gear blanks. Cylinder that actuates slides is mounted beneath load magazine at left.

In-line transfer of gears through a shaving operation is accomplished in this machine by the coordinated action of two air cylinders. Three stations—load, shave and unload—are included in the transfer layout.

At the start of the transfer cycle two jaws mounted on a slide are positioned to hold gears at the load and shave stations. Activation of the first cylinder moves the slide 12 inches, the distance between two successive stations. This movement carries the shaved gear to the unload chute and the incoming gear to the shave station. At this point a smaller cylinder mounted on the slide causes the jaws to retract, allowing the slide assembly to return to its starting position. Retraction is necessary to eliminate interference between the transfer jaws and the work. After the slide returns to its starting position, the second cylinder is deactivated and the jaws again move into position to hold the work. This completes the transfer cycle.

The gear shaver and transfer unit are both products of National Broach & Machine Co., Detroit.

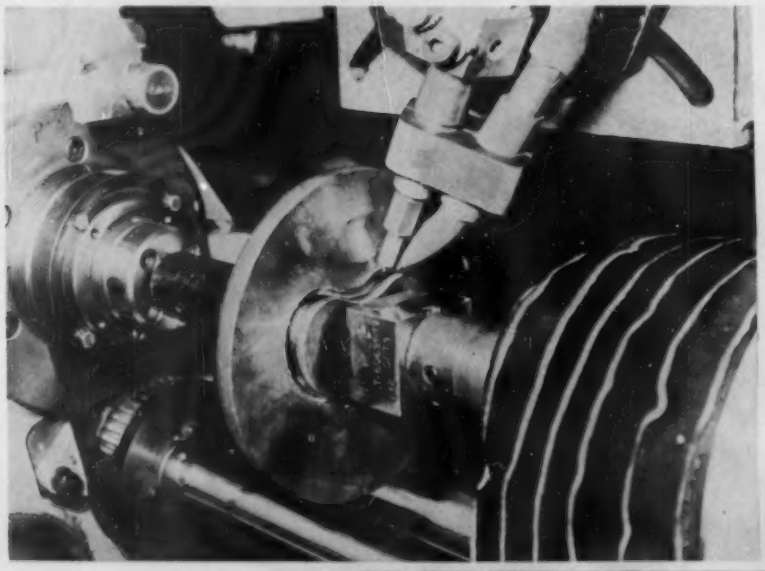
DRAWING of the transfer assembly. Except in transfer between stations, parts are moved by gravity. Movement is shown by phantom view at right.



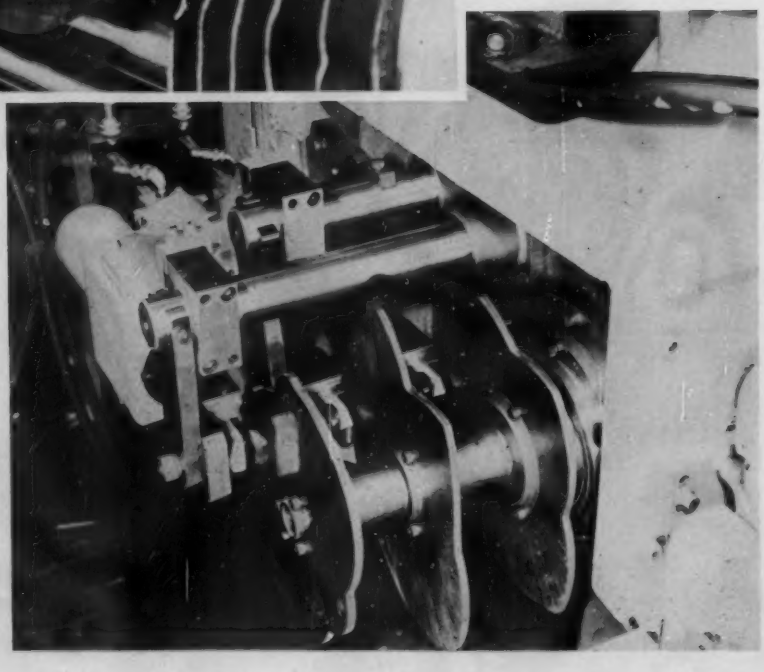
Cams Control Machine Functions in Contour Welder

WELDING of irregular contours, a type of work normally performed by special purpose machines, is accomplished on a large variety of jobs in this universal welder. Designed by Expert Welding Machine Co., the welder is guided through its cycle by cams. One cam controls rotary speed and thus insures a constant linear speed of the workpiece past the welding heads. Two other cams control horizontal and vertical positions of the welding head throughout the welding operation.

Design of the machine is similar to that of a lathe in that the workpiece is mounted between a headstock and tailstock. Unlike a lathe, an adjustment is provided which enables the operator to elevate the tailstock. This permits a shift of the axis of rotation. Another adjustment on the machine provides puddle control, allowing the operator to make either a concave or convex weld bead.



MACHINE WELDING of an irregularly shaped part to a plate. Rotation of the headstock and tailstock is synchronized and variable to provide constant welding speed on irregular shapes.



CAM ASSEMBLY for controlling head positions and speed of rotation. Formulas and charts make cam layout a simple procedure.

Fig. 1. Tooling for modern automatic threading machine, using single-point carbide tool. When the desired thread length is cut, tool is automatically returned to its initial position.

SINGLE POINT THREAD CUTTING goes automatic

By **Ralph L. Glaser,** Chief Engineer
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Brooklyn, N. Y.

Because of its productivity and accuracy, automatic single-point thread cutting is coming into new prominence. The author, who is a well-known expert on thread cutting, compares various thread cutting systems and outlines some of the considerations that are important when selecting threading methods for high production.

BECAUSE of the need to reduce manufacturing costs, automatic production methods are being emphasized in today's plants. Automatic thread cutting processes, for example, are being widely applied. This is particularly true of high-production single-point carbide tool thread cutting, *Fig.* 1, which offers many advantages over other cutting processes. Machining time is considerably shorter than for thread grinding or milling and high-quality finishes are obtained. Moreover, the cost of a single-point threading tool, particularly of the throwaway insert type, is lower than the cost of grooved thread milling cutters or diamond-dressed form grinding wheels. Further, setup time for single-point threading is minimal.

Automatic single-point threading is essentially a faster version of standard thread cutting on a lathe. Because of the fast automatic cycle, how-

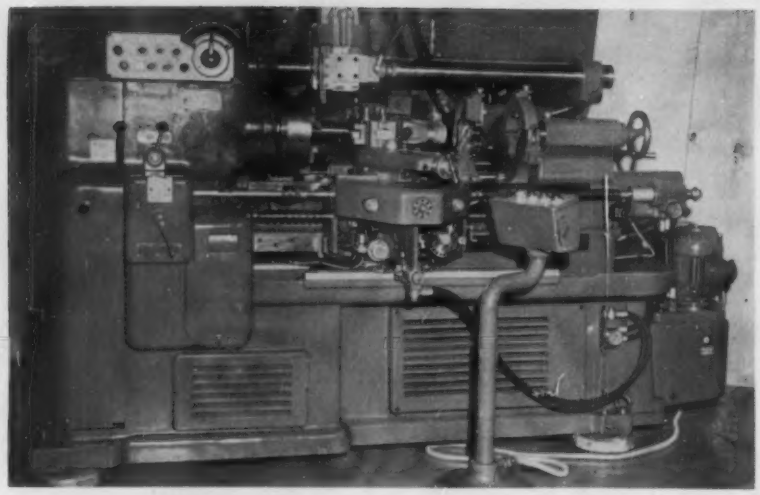


Fig. 2. Heavy construction and easily-reached controls are characteristics of modern single-point threading machines like this one.

ever, minimum time is spent in withdrawing the tool at the end of the cutting pass, returning the lathe carriage to the start of the subsequent cut and setting up each cut to the right depth. Once the initial setup has been established, the need for direct operator control is eliminated. In many cases, one operator can run several machines, thereby reducing direct labor costs.

Cam Systems: In most automatic threading machines, the required automatic motions are actuated by a cam or a helix, either front or angular. A roller, part of the toolholder carriage and held in place by a spring or restricted in an accurate groove, slides on the profile of the cam. The length of the thread is governed by the distance from the minimum point to the maximum point of the eccentricity of the cam or helix. Therefore, when cutting a four-inch-long thread, it is necessary to have an eccentricity four inches long.

During the full-circle rotation of the cam or helix, the tool goes through its complete cycle of cutting and return to the starting point. Out of the 360 degrees of cam or helix profile, only 240 degrees are used for the cutting stroke. The remaining 120 degrees are used for the return stroke. The accuracy of the thread pitch is controlled by the shape of the "cutting portion" of the cam.

The cam and the spindle are connected by a gear train, since the spindle must make a number of revolutions equal to the number of spirals or turns in the length of the threading, while the cam can make only two-thirds of a revolution during the same time. Play between the gears, or any angular error, is magnified and can adversely affect pitch accuracy. Similarly, the slightest wear on the profile of the cam or helix will lead to pitch error. Since the toolholder carriage, which produces the longitudinal motion during cutting, is actuated by a roller that touches on one point of the cam or helix, thread inaccuracies will result if there is poor contact. Thus cam-controlled systems must be carefully maintained for best results.

Leadscrew Systems: There is a widely used method for threading on a lathe in which the toolholder carriage is moved by an integral leadscrew that is actuated by a motion-reversing mechanism. This mechanism is driven by the main shaft, through the gearbox used for obtaining the pitch lead. The same system is used on some automatic threading lathes. With a precision leadscrew driving the threading carriage through a long bronze nut of equal precision, it is possible to obtain greater accuracy than with those systems using cams or helixes, especially when cutting long threads. Wear of the leadscrew and nut can, of course, cause errors, but in actual production this is almost never a real problem.

These automatic machines overcome one of the major disadvantages of conventional thread cutting on a lathe. In ordinary lathe operations, the reversal coupling, made with a single-tooth clutch in order to always engage in the same angular position, is located in front of the ratio gears. With this arrangement, the spindle speed must be kept relatively low, because the teeth of the coupling, which rotates at the same rate as the spindle, are subject to constant wear when meshed. Further, with ordinary lathes, when the direction of the motion is reversed, the whole chain of the ratio gears sets up high inertial moments. The impact stresses that occur during the motion change cause the breakdown of the gear teeth. As a consequence, low speeds must be used and cutting operations are performed at speeds that are far below the optimum speeds for single-point carbide tools.

In the type of leadscrew-actuated machine shown in *Fig.* 2, the reversal coupling is located between the pitch gear box and the leadscrew. The rotation

of the leadscrew, which is directly connected to the coupling, controls the motions of the toolholder carriage. The ratio change gears do not reverse their direction of motion, so no damaging stresses can develop.

Using a coarse-pitch leadscrew, the angular speed of the coupling will always be low and there will be no impact. For example, with a 1-tpi leadscrew and cutting a 20-tpi thread, the spindle can revolve at 2000 rpm while the coupling is reversed at 100 rpm, with negligible inertial affects.

Since the pitch to be cut must always be a multiple of the leadscrew pitch, the 1-inch pitch leadscrew allows threads having a whole number of teeth per inch—4, 5, 6, 7 and so on—to be cut. Fractional pitches—4.5, 5.5, 6.5 and so on—cannot be cut since they are not multiples of 1.

Cutting of fractional pitches is made possible by a set of gears located in a secondary gear box between the reversal coupling and the leadscrew. By proper setup of gears in the primary and secondary chains, practically any pitch can be cut—whole number, fractional, diametral and multistart. Metric pitches require a 30 mm pitch leadscrew.

Pitch Accuracy: While a machine of the kind just described is inherently highly accurate and is not subject to some of the troubles associated with other designs, heating at the workpiece during machining can cause problems. For example, cutting a thread 32 inches long develops so much heat that when the workpiece is cooled the pitch will be shorter than desired, due to the thermal contraction. To compensate for this source of error, the leadscrew pitch can be modified, making it longer by the exact amount needed.

Cycle Time: Machine cycle time per part can be quickly calculated, using the following formula:

$$T = \frac{2\ (L + 1)nN}{S}$$

where T is machining time, minutes; L is length of thread, inches; n is the number of threads per inch; N is the number of passes and S is the spindle speed in revolutions per minute.

For practical purposes, the controlling factor in machining time is tool life. With carbide tools, high speeds are possible and tests have shown that ceramic tools can be run at still higher speeds.

Because of its accuracy, its versatility—which can be increased by using attachments for tracing, facing, necking off and cutting—and because of its high speed, modern single-point threading affords real savings in time and cost where threading production requirements are high.

Computers Parallel Management Lab

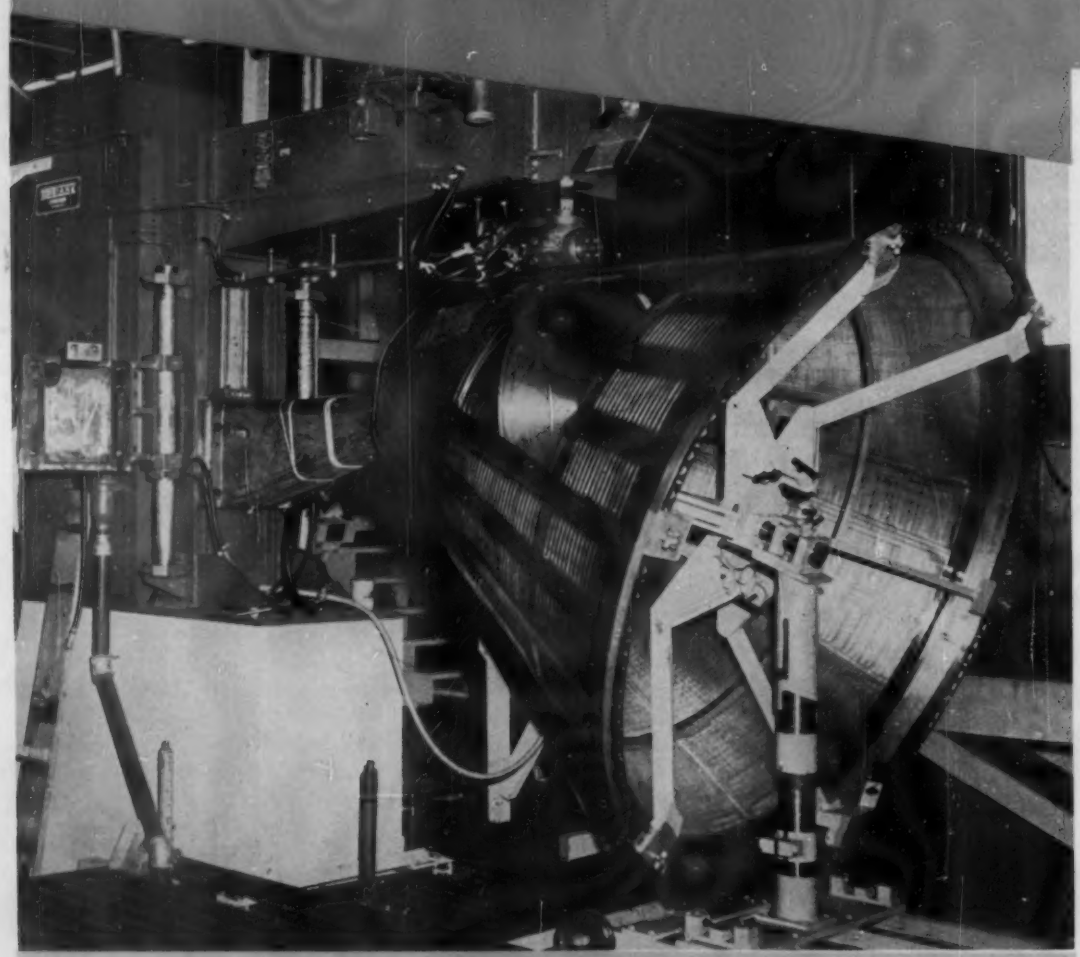
PROJECT SCHEDULING, inventory control and capital investment are three critical business areas which benefit from new computer programs developed by International Business Machines Corp. With the programs, a computer can simulate, in mathematical terms and at high speed, an almost limitless variety of business situations.

Project scheduling is accomplished in three separate but related phases. First, an arrow diagram is made showing each job and its relationship to all other jobs in the project. Also shown are numerical notations of the time required for each job and each job's logical place in the project sequence. The scheduling phase of the program in turn uses the diagram to calculate the earliest and latest time that any job can start and finish, and pinpoints those jobs which cannot be delayed without lengthening the entire project. Next, the computer calculates various time-cost relationships ranging from the most expensive to the least expensive way. If desired, it can compute the time required to complete a project without exceeding a specified cost and, if a project must be accelerated, indicate at what points the project can be expedited.

The inventory control system—the second of these activities—uncovers the most effective inventory policy by simulating the effects of varying conditions of demand on all possible inventory situations. A mathematical model of an inventory system is constructed within the computer and external factors such as demand, review period, order point, lead time, protective stock level and forecast factors are introduced. The data is processed by the computer and a printed report is produced showing what would have happened if any of these conditions had occurred.

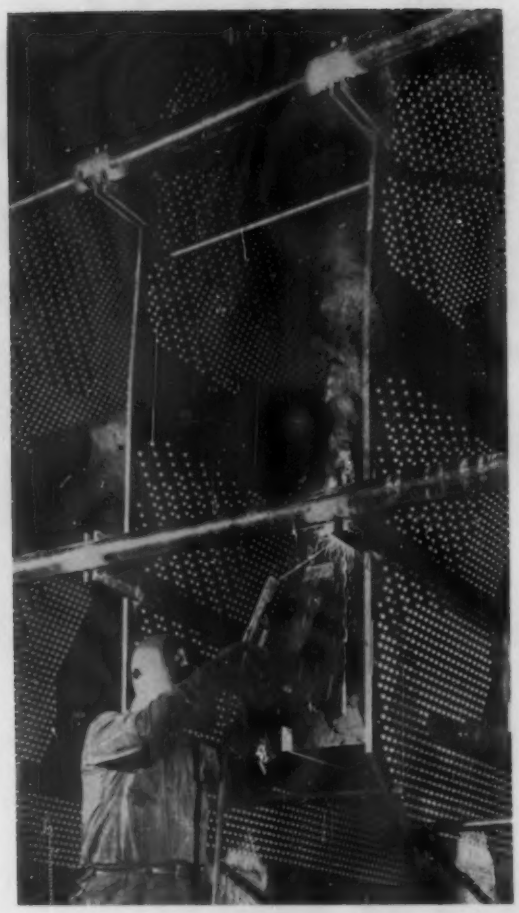
IBM's capital investment program enables management to determine in advance the profitability of a proposed capital investment by evaluating all factors affecting the rate-of-return. It mathematically analyzes salvage or trade-in value, interest charges on borrowed capital, depreciation charges, earnings pattern, reinvestment of earnings and estimated useful life. If the value of some of these factors is unavailable, the program can generate its own values based upon anticipated obsolescence.

TOOLS at work



BASICALLY an all-titanium structure, the capsule for the Project Mercury man-in-space shot is assembled by welding. A sandwich of two titanium sheets welded to a truncated conical rib structure of titanium forms a protective cocoon for the astronaut against the critical combinations of accelerations, heat loads and aerodynamic forces facing his space vehicle during boost and re-entry. Here the two cones are being joined on a standard seam welder. Previously, the cones have been individually built up from trapezoidal sections, butt-welded together. All seam and spot welding is done "open air," using techniques similar to those used for stainless steel. Operation is at McDonnell Aircraft Corp.

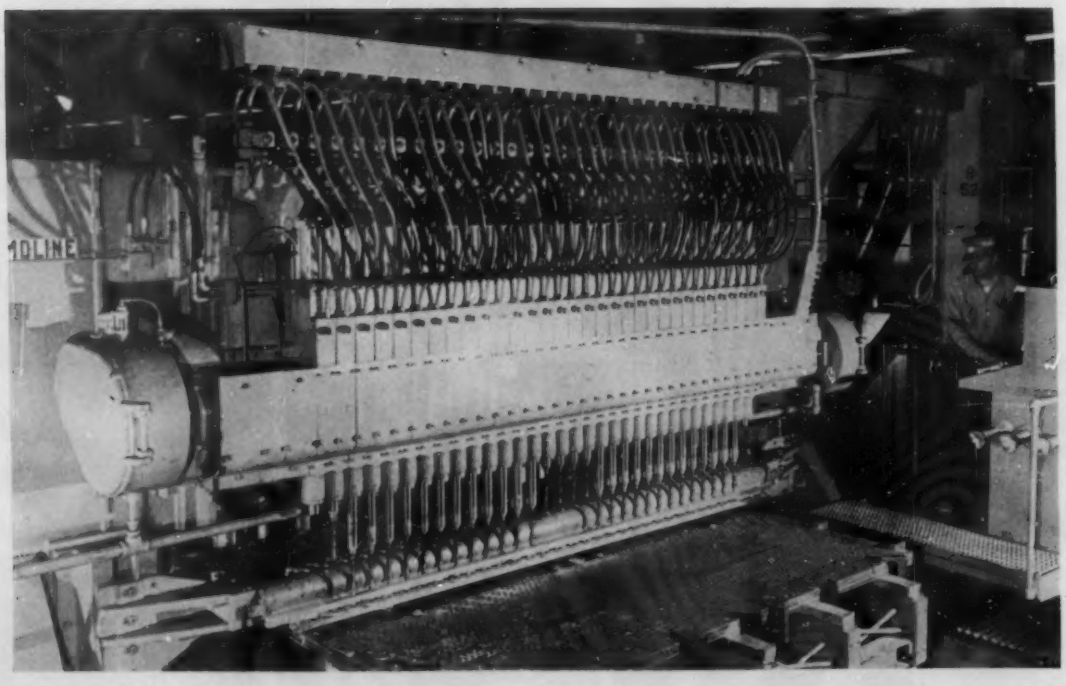
TECHNICIANS inspect interior of Project Mercury space capsule after welding of double skin to conical rib structure. Corrugations or beading of the metal in the outer skin gives added strength, making the 0.020-inch-thick metal equal in rigidity to an unbeaded skin 0.050 inch thick, resulting in a more favorable weight-to-strength ratio. Use of titanium, which weighs 44 percent less than steel, yet provides equal strength, also improves weight-to-strength ratio. The titanium, furnished by Titanium Metals Corp. of America, withstands re-entry temperatures of 600 F, protecting the capsule and pilot.



OPERATOR uses offhand welding to assemble steam condenser for an electric generating station. Completed generator has up to 12 sets of support plates, each of which may have up to 16,000 holes. Some 100 miles of copper tubing is used in the average generator. This tubing passes through holes in the support plates, which must be accurately located.

TOOLS at work

TAPE-CONTROLLED, this 32-spindle machine (below) drills more than 2000 holes per hour in ¾-inch-thick support plates at Worthington Corp. Under guidance of the tape, the head moves over the plate to position the drills for each bank of holes. Plates as large as 165 square feet can be handled in the machine. With tape control, holes are located more accurately than with hand layout methods and hole size is more accurately controlled. Virtually every condenser requires a different hole pattern. Tapes for any one pattern are stored, used as needed, thus simplifying change-overs.



RUSSIAN AUTOMATION —where it stands today

By N. G. Neuweiler
Geneva, Switzerland

The author, a Swiss engineer and editor who keeps in close touch with Russian developments, finds that Russian industry lags far behind American industry in the field of automation. But good progress is being made and Russian engineers have some ambitious plans for the future.

RUSSIAN MANUFACTURING ENGINEERS are relying on automation for dramatic increases in productivity. Today, however, automation is the exception, rather than the rule, in Russian plants. Within the next decade, this picture should change. Production of automated machines and automated manufacturing lines is up, and research and development leading to improved automation devices and instrumentation is being emphasized. These are some of the conclusions that can be drawn from reading recent Russian literature dealing with the manufacturing sciences.

Several hundred transfer lines for the machining of parts such as engine blocks are in operation in Russia. Rotary machines in which tools travel with the workpiece, machining while the workpiece is in transit, are in use.

Automatic control devices that check the dimensions of workpieces, feed back corrections to the machine and also sort finished pieces into "acceptable," "scrap" and "reparable" categories are found in some plants. Russian engineers feel that automatic controls of this type are essential to true automation; also that in true automation all machine functions must be automatic.

Automation is only a part of the effort to increase productivity. Carbide tools are extensively used to gain higher cutting speeds and ceramic tools are rapidly being adopted. Machining time is being reduced by the application of more power to machining operations. Rapid chucking devices are being widely applied. Ways to reduce downtime are being studied. In one plant, for example, stoppages of an automatic machining line caused by the breakdown of one machine are avoided by providing magazines of partially finished workpieces between operations. These workpieces are automatically fed into the production system as required, thus maintaining continuity of production.

The long-range objective of Russian manufactur-

ing engineers is the completely automatic factory. Despite advances in technology that have been applied in a few plants, this objective is far from realization. Inspection operations still remain a bottleneck in most plants. Mechanized inspection methods are relatively uncommon. In many cases, inspectors comprise up to 40 percent of the total working force in a plant. In a plant that manufactures steering gear housings, machining time is 2.5 minutes while inspection time is 3.5 minutes. In thread manufacture, inspection operations require ten times as long as machining operations.

Although hundreds of thousands of inspectors are at work in Russian manufacturing plants, scrap losses are extremely high by American standards. It is estimated, however, that a 30 percent reduction in scrap will be realized during the next seven years, when more than 30,000 automatic inspection devices will be built for installation in machine tools.

Many of the machine tools used in Russian industry are technologically obsolete. It is planned to replace these obsolete machines as soon as possible. The Russian machine tool industry is not large enough, however, to permit any large-scale re-equipment of Russian plants in the immediate future. For this reason, the modernization of existing equipment is being emphasized.

This modernization extends to entire production lines as well as to individual machine tools. There are about one hundred fully automated manufacturing lines made up of modernized machine tools in Russia today. The total number of automatic lines of this kind may reach 2000 if present plans are carried out.

Some of the modernization work is done in the plants where the machines are used. There are also centers that specialize in modernization and improvement projects. One such center is Enims, which specializes in machine tool modernization; another is Woronej, which specializes in the field of die forging machines.

Other centers design and manufacture building-blocks that can be mounted on various types of machine tools. Standardized power trains equipped with electromagnetic clutches, for example, are being produced in quantity for the modernization of shapers. Devices for copying, rapid chucking and automation are also being manufactured on a large-quantity basis in specialized plants. This large-quantity production has substantially lowered the cost of machine and production-line modernization. It has been estimated that the cost of modernization normally does not exceed 20 to 30 percent of the cost of a new machine. With small-quantity production of components, modernization costs would run up to 50 percent of the cost of a new machine.

Russian engineers plan to modernize over 400,000 machines during the next few years. On the average, modernization has increased machine productivity 30 to 35 percent. Conservatively, modernization will result in increased productivity equivalent to that obtainable from 120,000 new machines—a benefit that has been gained without increased floor space and without high investments.

The Russian automobile industry, concentrated in works at Gorki and Moscow, has been able to increase its productivity some five times since 1946. The main factor in this improvement has been the introduction of automation. The Moscow works does not rely entirely on new automated machines fabricated elsewhere—it makes its own. During the past five years, it received 145 new automated machines and built 400 of its own. Also, it converted about 350 older machines for automatic or semi-automatic operation and built 44 major machine loading and parts handling devices.

Automation can be applied only when production volumes are large enough to justify the investment. Russian engineers are conscious of this and are making efforts to standardize products and their components to a sufficient extent to make automation economically feasible. The Leningrad metallurgical works has been able to standardize approximately 80 percent of the parts in a variety of hydraulic turbines that it produces and standardization of turbine blades approaches 100 percent. Thus it is able to manufacture most parts efficiently.

Gear manufacture represents an area where great improvements in efficiency could be made through standardization. At present, each Russian machine works manufactures its own gears. Annual gear production is high and by 1976 it will reach 176 million pieces with a total weight of 570,000 tons. Over 10,000 different gear designs are currently being made. Even in an individual plant, from several hundred to several thousand gear designs may be produced. Russian engineers hope to reduce the number of gear designs to perhaps 400. This will make automatic production in quantity possible.

Insufficient electrical power has severely limited the application of automation in Russian industry. By 1965, generating capacity should be more than doubled, eliminating this problem.

The introduction of automation is also dependent upon the production of instrumentation of all kinds. Instrument production has increased 60 percent in Russia during the past decade. By 1965, it is hoped that the production of instruments for automatic measurement and control of industrial processes will be more than doubled. Production of computers should quadruple during the same period.

All in all, it appears that Russian engineers have sufficient technological ability to make the automatic factory a reality. Russian industry, however, lags far behind American industry in most respects. Despite the rapid rate of Russian progress, it will be years or even decades before automation becomes the rule in Russian plants.

converting a drill press for small-hole drilling

By Sam J. Yasho
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Martin Co.
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Drill presses can be easily and inexpensively converted to small-hole drilling. After conversion, hole production increases, costs are cut and skilled labor is released for more productive work. The author explains how conversion can be effected at minimal cost.

ALTHOUGH THE HUMAN HAND is admirably suited to the operation of machinery, it is little more than a crude and clumsy appendage when it is used to operate small-hole drilling equipment. Only the most highly skilled machinists can manually drill a hole of 0.005-inch diam or less. Because of their skill, these men are often tied up on other jobs of more importance. In addition, their ability to drill small holes successfully is inhibited by such factors as fatigue and boredom.

To eliminate the operator as a controlling factor in small-hole drilling, one company has devised a feed-control attachment that can be adapted to virtually any type of drill press, *Fig.* 1. In this assembly, drilling forces are provided by a weight on the drill press handle. As in virtually all examples of small-hole drilling, spindle movement is limited to rotation; feed is provided by table movement.

Components: Basic components of the attachment are a ½-rpm synchronous motor, a 40-tpi leadscrew, spur gears of 1.5 to 1 ratio, a mounting plate and a special table attached to a rack type column. These units, working in conjunction, feed the workpiece to the drill at rates as low as 0.000004 ipr.

In the feed unit, illustrated in *Fig.* 2, the larger of the two gears is fixed to the motor and the smaller to the feed shaft. The feed shaft, which extends upward through the mounting plate by way of two bearing races, is splined into the leadscrew. In this way, rotation of the shaft results in a downward movement of the leadscrew. The practical utility of the screw movement can be seen by an analysis of the action of the assembly, *Fig.* 1. The column, which has an integral gear rack, is geared to a pinion in the fixed adjustable knee. A cap, set in a thrust bearing which is mounted at the end of the leadscrew, bears against the knee. When the synchronous motor is shut off, this cap acts as a stop in that it prevents upward motion of the column through the knee. Any retraction of the leadscrew permits a corresponding rise of the column as long as pressure is maintained on the handle. In this assembly, requisite pressures are maintained by the adjustable weight.

The purpose of this assembly is to provide a uniform but extremely slow rise of the column through the fixed knee by gradual retraction of the leadscrew. This is accomplished by rotation of the leadscrew by the synchronous motor.

Other important components in this setup are a torque-limiting chuck and an indicator. The chuck minimizes drill breakage and the indicator shows drill position, an important consideration in maintaining chip-free holes.

The drill press is also of primary importance because small-hole drilling requires a rigid, accurate and extremely fast spindle. Runout must be minimal since variations of even 0.0001 inch can result in drill breakage. Simultaneous control of both the drill press and the feed unit should be provided by a floor switch that actuates both units.

Operational Sequence: Before drilling begins, the drill and workpiece are brought into close proximity with the positioning knob. The drill press and

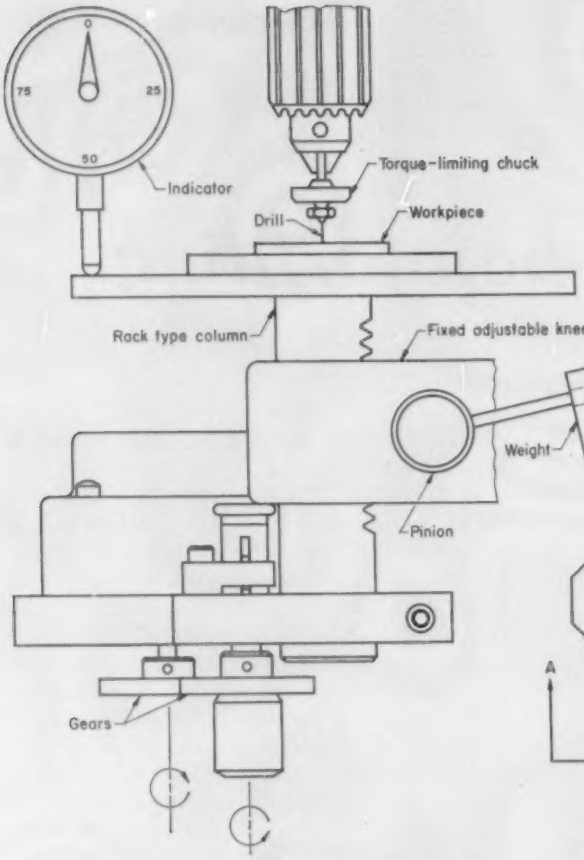
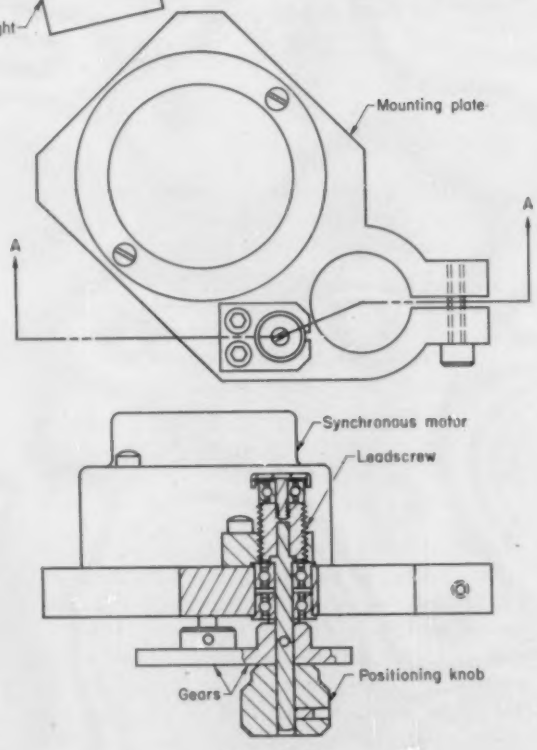


Fig. 1. (left) Feed-control unit mounted on drill press. Fixed adjustable knee is drill press component in which assembly is mounted.

Fig. 2. (below) Details of the feed-control unit. Leadscrew is shown in its retracted position.



feed-control unit are then started with the foot control. As drilling begins, close observation of the hole is necessary to determine whether or not the drill is cutting properly. If the machine and drill are functioning correctly, the hole will be straight and show no signs of bellmouth. Should the hole be bellmouthed, it indicates either a dull or defective drill. In either case the drill must be discarded because sharpening of small drills is impractical. The operator can easily inspect the hole with a microscope or magnifying glass.

If the hole is satisfactory, the operator can proceed, stopping only to clear the drill and hole of chips. When holes of 0.005-inch diam are drilled, it is necessary to clear the drill at intervals of 0.010 inch. It is also necessary to keep the drill well lubricated, an operation that is best performed with a small sable hairbrush. Tapping compounds diluted with oil of wintergreen usually provide the best lubrication.

A number of precautions must be taken in even the best of small drill setups. For one, the operator should never attempt to drill a prick-punched mark. Even a 0.0001-inch deviation from the center is enough to cause drill breakage. Deeply scribed lines can also cause drill fracture.

Another precaution concerns drill depth: holes should be drilled no deeper than 85 percent of the flute length, especially in alloy steels. It is also necessary to exercise care in backing off the drill when the hole is inspected. Generally, a distance of 0.005 inch as shown on the indicator is sufficient. Backing off is accomplished with the positioning knob on the feed shaft.

With proper construction, good drills and strict adherence to the operational procedure outlined in this article, the feed-control unit gives excellent results while minimizing losses due to scrap. Best of all, it changes small-hole drilling from a highly skilled craft to a routine machine operation.

REFERENCE SHEET

welding titanium

SUCCESSFUL WELDING of titanium depends on an understanding of the material and strict observation of some basic rules of weld geometry. Knowledge of these subjects enables fabricators to achieve good welds without excessively large expenditures of money on capital equipment.

During welding, titanium and its alloys are subject to embrittlement by relatively small amounts of oxygen and nitrogen. Less than 0.5 percent of either element will embrittle the weld beyond the point of usefulness. In addition, titanium has a high affinity for these elements at elevated temperatures and should be shielded from normal atmospheric conditions during welding. It is also necessary that the weld area be free from dust, grease and contact with ceramic blocks. Similarly, coated arc welding electrodes and fluxing compounds cannot be used because of titanium's high reactivity with virtually all materials.

Excessive alloying of titanium with other materials such as steel and aluminum greatly reduces its ductility and impact strength. For this reason titanium cannot be satisfactorily welded to other metals although titanium alloys can be welded to each other without difficulty.

Two types of fusion welding for titanium are possible. These involve use of either consumable (tungsten-arc) or nonconsumable electrodes surrounded by inert gas such as argon or helium. Of the two, the nonconsumable electrode type is the more widely accepted. Used extensively on sheet materials ranging up to 0.125 inch thick, it is also employed successfully on heavier materials. In thicknesses above 0.250 inch, however, the inherent advantages of consumable-electrode welding become apparent. The tungsten-arc method offers advantages in that it permits greater control of physical aspects of the weld such as penetration and width of fusion zone. Also, there is no spatter and the weld appearance is smooth and uniform.

Consumable electrode welding (known as sigma welding) offers advantages in that it provides more metal deposit per unit of welding time while keeping the number of welding passes required at a minimum—an important factor in welding titanium. Used principally on heavier metals, it has been used successfully on metals as thin as 0.125 inch.

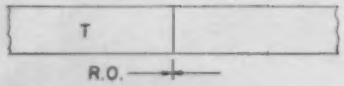
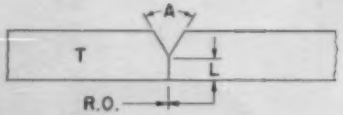
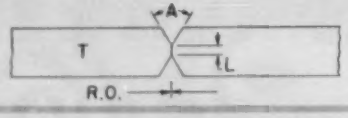
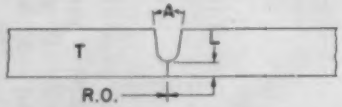
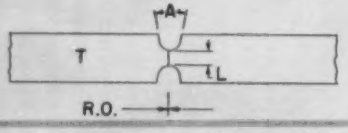
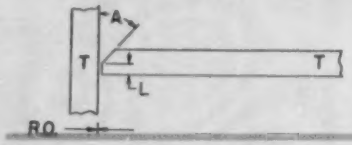
The decision to use filler wire with tungsten-arc welding depends largely on the gage of the material being welded and the joint fit-up. Use of the wire increases the possibility of contamination if the wire has not been thoroughly cleaned or if the hot end of the wire is inadvertently exposed to air during intermittent welding. In the latter case, the end should be cut off before welding continues.

Filler wire may be added to the titanium weld joint in various ways. It may be fed by hand during manual welding or inserted between the joints before welding begins. This practice, although often practical, greatly increases the possibility of oxidation through entrapped air, and the use of a feed attachment is recommended. With sigma welding, the wire itself is the electrode.

Joint designs for titanium welding are similar to those used for other metals. Typical designs are shown on the following page. Many other types must, of necessity, be used and the illustrations given are presented as a guide. Of paramount importance in any weld is the fit-up of the joint; if the joint is loose, molten metal falls through and greatly increases the possibility of contamination from entrapped air, particularly when welding thin materials using filler wire. Close fits in the joints and tight clamping of the workpieces eliminate this problem. This precaution and use of high purity gases will generally enable the operator to effect good titanium and titanium-alloy welds.

From "Titanium Welding Techniques," published by Titanium Metals Corp. of America.

Titanium Welded Joint Design

Drawing	Weld Type	Thickness Range (in.)	Weld Pass Type	Electrode Type	Electrode Diam (in.)	Filler Wire Diam (in.)	Root Opening (R. O.)	Angle of Bevel (deg)	Width (in.)
	Square Butt	0.010-0.062	Single	Tungsten*	1/16	None	0	—	—
		0.031-0.125	Single or Double†	Tungsten	1/16	None	0	—	—
		0.031-0.125	Single	Tungsten	1/16-1/8	1/32-1/16	0-0.10T§	—	—
	Single Vee	0.062-0.125	Single	Tungsten	1/16-3/32	1/16	0-0.10T	30-60	0.10-0.25T
		0.125-0.250	First	Tungsten	1/16-3/32	None	0-0.10T	30-60	0.10-0.25T
			Second	Tungsten	1/16-3/32	3/64-1/16	—	—	—
		0.125-0.500	First	Tungsten	3/32-1/8	None	0-0.10T	30-90	0.10-0.25T
			Second	Consumable	1/16	—	—	—	—
		0.125-0.500	Single-Multiple	Consumable	1/16	—	0-0.10T	30-90	0.10-0.25T
	Double Vee	0.250-0.500	Double	Tungsten	1/16-3/32	1/16	0-0.10T	30-90	0.10-0.25T
		0.250-0.750	Double	Consumable	1/16	—	0-0.10T	30-90	0.10-0.25T
		0.750-1.500	Double-Multiple	Consumable	1/16	—	0-0.10T	30-90	0.10-0.25T
	Single U	0.250-0.500	First	Tungsten	1/16-3/32	1/16	0-0.10T	15-30	0.10-0.25T
			Second	Tungsten	1/16-3/32	1/16	—	—	—
		0.250-0.750	First	Tungsten	1/16	None	0-0.10T	15-30	0.10-0.25T
			Second	Consumable	1/16	—	—	—	—
		0.250-1.000	Multiple	Consumable	1/16	—	0-0.10T	15-30	0.10-0.25T
	Double U	0.750-1.500	Double-Multiple	Tungsten	1/16-3/32	1/16	0-0.10T	15-30	0.10-0.25T
		0.750-1.500	Double-First	Tungsten	1/16	None	0-0.10T	15-30	0.10-0.25T
			Double-Multiple	Consumable	1/16	—	—	—	—
		0.750-2.000	Double-Multiple	Consumable	1/16	—	0-0.10T	15-30	0.10-0.25T
	Fillet	0.031-0.125	Single or Double	Tungsten	1/16	None-1/16	0-0.10T	0-45	0-0.25T
		0.125-0.500	Single or Double	Tungsten	1/16-3/32	1/16	0-0.10T	30-45	0.10-0.25T
		0.250-1.000	Single or Double	Consumable	1/16	—	0-0.10T	30-45	0.10-0.25T

* Thoriated tungsten electrodes; † Double pass, one pass each side; § T = thickness of base material.

JUDICIAL

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ENGINEERING CONFERENCE

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EDUCATION

CONSTITUTION AND BYLAWS

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PUBLIC RELATIONS

HONOR AWARDS

CONVENTION

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astme in action

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Committee Changes

—what they mean

A GROUP of far-sighted tool and manufacturing engineers recently made some far-reaching changes in committee structure to streamline the efficiency of Society operation and produce better service for the 41,000 members.

ASTME leaders approved the current committee changes at the 1961 Annual Meeting. Already in effect at the national level, these changes will become more familiar to the individual member as they go into operation in all Society chapters.

Perhaps the most significant change is the reorganization of the Education Committee into four subcommittees under the direction of a general chairman. Significant, because the four smaller, more specific groups—college and university education; technical institute, junior college and high school education; chapter education; and professional development—will accelerate ASTME activities in a field that is of prime importance and practical value to members.

If an engineer wants to increase his value to his industrial employers at a reasonable rate, he should devote about one-third of his productive hours to self-education and improvement, wrote Thomas Stelson, head of the civil engineering department at Carnegie Institute of Technology, in a recent issue of *The Carnegie Alumnus*. Dr. Stelson added that the decline in value or obsolescence of engineering personnel will become an increasingly serious problem unless professional societies, employers and schools recognize its importance and develop suitable remedies.

ASTME is tackling this problem through its new education subcommittees. The chapter education group is concentrating on improving and increasing the educational facilities available to members, such as instructional materials and courses on the various facets of tool and manufacturing engineering. The professional development group is encouraging the professional growth of the individual member and the field as a whole. The other two subcommittees are working for the improvement of tool and manufacturing engineering education in secondary and technical schools as well as in colleges and universities.

Since the Society's professional development activities are now being carried out—with equal emphasis—by an education subcommittee, the Professional Development Committee as such has been eliminated.

Another major change divides the functions of the Program Committee among three newly created committees to give separate and increased direction to the Society's national programs, chapter programs and convention planning. The national programs—Engineering Conferences held at annual and semiannual meetings, National Creative Manufacturing Seminars and On-Campus Conferences—are now being supervised by the Engineering Conference Committee. A Chapter Programs Committee is responsible for providing and improving programs at the chapter level only. And a Convention Committee is in charge of preparing host committee chairmen for annual and semiannual meetings.

Two New Committees Established

To insure that qualified committeemen are appointed to direct ASTME activities, a new Qualification Committee will screen all nominations for national committeemen. Chairmanned by the national secretary, this committee includes the four nonofficer directors who are youngest in point of service on the board.

A second new group—the Annual Review Committee—will each year review, evaluate and assess the progress of the Society toward its objectives. It will consist of all the nonofficer directors except the past president.

Other committee changes regulate the number of members needed to carry out national committee functions. The Editorial Committee has been reduced to three members; the Standards and Membership committees, to seven members each.

Toronto Hosts Plan Work-Play Program

Toronto Host Committee members (left to right) W. H. Weatherhead, Fred Roult and Ron Tipping review final plans for the two-day ASTME Semiannual Meeting to be held in their city next month.

SINCE SEPTEMBER 1960, the nine men and one woman of the Toronto Host Committee have been planning for the 29th ASTME Semiannual Meeting, to be held at the Royal York Hotel next Oct. 26-27.

The two-day program they have planned holds something of interest for every registrant. Three Techtours, which combine technical papers with related plant tours, will follow the meeting's main theme, "Economy in Manufacturing." Among the plants to be visited are Canadian Acme Screw and Gear, Ltd.; De Havilland Aircraft of Canada Ltd.; Canada Cycle and Motor Co.; Canadian Kodak, Ltd.; and Massey-Ferguson, Ltd.

Bruce Fairgrieve (right), general chairman of the host committee, and George H. Churchill, technical activities chairman, appear well pleased with the technical program they will present to registrants of ASTME's semiannual event.

But Toronto, which contains a higher concentration of manufacturing than any area of similar size in Canada, is more than a manufacturing center. It also has scores of historical and cultural attractions and contains some of the most picturesque spots in the Province of Ontario. The ladies' activities committee has seen to it that the femmes attending the meeting will see some of these scenic spots. During a visit to one of the city's most famous show places —the Old Mill Restaurant—the ladies will tour the beautiful grounds, choose luncheon from a continental bill of fare and sip coffee in an atmosphere of romantic old-world charm.

Besides planning the engineering and social aspects of the meeting, the host committee has also arranged for sessions of the Society's officers and directors. A dinner and a dance, both at the Royal York, complete the agenda for all registrants.

Lineup of Toronto Hosts

Bruce Fairgrieve, vice president, Fairgrieve and Son, Ltd., is general chairman of the host group and assisting him are hosts George H. Churchill, technical activities chairman; Bill Weatherhead, supplementary activities chairman; Bob Roberts, publicity chairman; Eric Brown, plant tours chairman; Fred Roult, reception chairman; Frank Knott, transportation chairman; and Ron Tipping, secretary. Hostess in the group is Mrs. Bill Weatherhead, ladies' activities chairman.

W. D. Luddington, tickets chairman, was killed in an automobile accident July 28 in Toronto. His host committee responsibilities will be carried on by another member of the committee.

The host group has worked to make the two-day stay in Toronto both informative and entertaining. Drawing from the city's tradition of hospitality they have done much to enhance a location which is a natural place of meeting for tool and manufacturing engineers from all over the world.

Long Range Planning Shows Results

LONG RANGE PLANNING is over, but its tangible results in ASTME are just beginning.

The planning started in late 1958 when the LRP Committee embarked on a thoroughgoing study of the Society's structure, functions, purposes and methods. Two years later, in a voluminous report to the board, the committee reaffirmed the basic objective upon which the Society was founded, outlined the organization's goals for the next 15 years and spelled out the changes in structure and activity requisite for the attainment of these goals.

Preparation of the LRP report was indisputably the longest—but only the initial—step toward action. Implementation of its recommendations necessitated further study by subcommittees. Its proposed changes in the Constitution needed approval by the membership in a referendum ballot.

Now the subcommittees have completed their tasks, the members have given their approval. And what *was* long range planning stacks up into two categories of action—immediate and future.

The immediate results of the LRP program, which will all be in effect by Oct. 1, strengthen present Society operation in four vital areas: membership requirements, finance, management, and committee activity. The new membership requirements will raise not only membership qualifications but the professional level of the Society and thus, the individual member's opportunities for self-improvement as an engineer.

In the realm of finance, a $5 increase in the annual dues of Senior, Associate and Regular members will help meet the rising cost of member services. Besides bringing members' dues more into line with the Society's member activity expenditures, the increase will also bring ASTME dues more into line with those of comparable engineering societies. Articles on both the increase in dues and the new membership requirements appeared in the August issue of this magazine.

A two-year term of office for national directors, with only part of the board elected each year, will provide greater continuity and stability in Society management. The new election procedure will begin with the next House of Delegates meeting. There, the delegates will elect 14 candidates; the seven who receive the highest number of votes will serve on the board for two years and the other seven, for one year. Each succeeding year, seven directors will be elected for a two-year term.

The changes in the area of committee activity are explained on Page 119 of this issue.

Long-range-planning action slated for the future will increase service to the member as well as the Society's capacity to serve. Most imminent in this category is the construction of a new ASTME Headquarters that can adequately house present activities and be expanded as additional space is needed.

As soon as it is practicable, ASTME will establish correspondence courses in the field of manufacturing technology. Such courses would provide comprehensive training, enabling members to improve their industrial knowledge and position. Another prospective service for the member—a central library service of tool and manufacturing literature—is discussed on the following page.

As changing times and a growing membership demand, the Society will add more services. For this, long range planning has left an open door.

Opportunity for Authors . . .

Technical authors are invited to indicate their interest in preparing engineering papers for presentation at the 1962 ASTME Convention in Cleveland. Papers may deal with any field of tool and manufacturing engineering. Proposals for papers will be reviewed by the Society's Engineering Conference Committee and should be sent before Oct. 1, 1961, to the Director of Conferences, 10700 Puritan Ave., Detroit 38, Mich.

Automated Library for ASTME?

AUTOMATION is the new look in library science, and the proverbial silent, strait-laced librarian is a flashing, humming computer that can help engineers solve their manufacturing problems. The computer is the focal point of a new development—mechanized literature searching—which is currently being investigated by ASTME as a possible means of providing its members with a central library service of tool and manufacturing engineering literature.

The type of library service most useful to members and most feasible for the Society is being studied by a subcommittee chairmanned by Vice President Verne Loeppert and consisting of directors Ben Berlien and Wilfred Pender.

In considering the automated side of library service, the subcommittee took a firsthand look at the American Society for Metals' project in mechanized literature searching, operated in conjunction with Western Reserve University in Cleveland. The ASM-WRU system revolves around a high-speed General Electric computer. Specially coded abstracts of current metallurgical literature—about 1500 every two weeks—are stored in the machine's tape memory and searches of this literature are offered on a subscription basis. When the subscriber sends in his question, the computer is programmed for that question and in a matter of minutes it produces the identifying numbers of all relevant abstracts. Reproductions of the abstracts are made and sent to the subscriber.

If the subscriber wants information on new developments as they are reported, he orders the "current awareness" service and receives abstracts referring to his specific subject every two weeks. If he wants abstracts of all the literature on his subject that was published and encoded during a given year, he orders a bibliographic search of that year. However, because the ASM program is too new to have built up an extensive backlog of encoded abstracts, bibliographic searches are limited to the past two or three years.

In considering manual literature searching, the subcommittee talked with a representative of Chicago's John Crerar Library. Like ASM, Crerar offers both the retrospective bibliographic search and the current awareness service on specific subjects. But because Crerar's searching is done manually, its current awareness charges must exceed those of ASM. Conversely, the retrospective search, based solely on existing indexing and abstracting publications, can be done more economically at Crerar.

The obvious advantage of an ASTME library service—whether manual or mechanical—would be its ability to keep the members completely current in their specific areas of engineering interest, despite the sheer volume of today's tool and manufacturing engineering literature. It would prevent duplication of engineering effort and would show the engineer where to find the information he needs to solve his manufacturing problems.

Recognizing these advantages, but realizing that such an expensive and complex service requires much study, the Society is planning to establish a permanent Documentation Committee to update ASTME's present published bibliographies—*Metal Cutting Bibliography and Plastics for Tooling*—and to take the responsibility for providing more comprehensive library service in the future.

Groomes Appointed Assistant General Manager

JOHN W. GROOMES has become assistant general manager of ASTME, following two years on the Headquarters staff as administrative assistant to the general manager. The appointment was recently announced in Detroit by General Manager Harry E. Conrad.

Before coming to the Society in 1959, Groomes was executive director of the national Junior Engineering Technical Society. Prior to that he taught advanced mathematics for two years and worked for several years in various engineering and supervisory capacities.

A veteran of World War II, Groomes majored in engineering at Case Institute under the Navy V-12 program. In addition, he holds a degree from Alma College and has done postgraduate work at both the University of Michigan and Michigan State University.

"... a better way of conducting Society business."

Joint Meeting Improves Communication

GIVING A TRIAL RUN to ASTME's first combined officer-committee meeting, the national officers and nine of the national committees met together in Detroit last July 7-9. According to the consensus, the prime advantage of the joint meeting was improved communication between the officers and committees as well as among the committees themselves.

In the past, each national committee has met at a separate time or place, with the one officer responsible for that committee. Meeting with the full officer complement in Detroit's Statler Hilton Hotel, the nine committees—Constitution and Bylaws, Education, Finance, Membership, Program, Public Relations, Research and Educational Grants, Standards and Technical Publications—began their week end of cooperative work at a briefing session with President Wm. Moreland.

While explaining a chart showing ASTME growth projections for the next ten years, Moreland told the committees: "All is not sweetness and light; we have some serious problems facing us.

"This particular group," he said, "has the job of overcoming these problems, the job of realizing the goals set for the Society in 1975. The Annual Review Committee will be watching our progress toward these goals, evaluating me on my ability to lead you; the officers, on their ability to motivate you; and you, on your ability to do the job."

After the briefing, the committees held individual sessions to set their goals and objectives for the year. The next day each chairman presented his committee's progress plans to the officers.

Answering questions in an on-the-spot interview July 9 in Detroit, President Moreland gave a concise appraisal of the new combined-meeting idea and discussed its potential for the future.

Q. Judging from this past week end, Mr. Moreland, what do you think are the advantages of the joint officer-committee meeting?

A. The big advantage, of course, is improved communication, which was the officers' chief reason for proposing this type of meeting. During the past two days, when one committee brought up a point that affected another committee, the answer was only a few steps down the hall. When the officers needed clarification on something pertaining to a specific committee, that committee chairman was readily available. Also, the chairmen had an opportunity to lay their committee plans before the whole officer group, not just their ex-officio member.

Another decided advantage, which was much in evidence all week end, was a spirit of cooperation among everyone involved, a togetherness in promoting the growth of the Society.

In addition, the combined meeting lessens travel expense for the officers and lightens demands on their personal time.

Q. Are there any disadvantages?

A. Yes, but only of a temporary nature. Our problem at this meeting was one of time. The fact that some of the committees are newly established groups as well as the changes in the officers' committee responsibilities caused the officers to spend more time than was planned at individual committee meetings. Consequently, their own meeting didn't cover its complete agenda. But I'm sure this can be corrected in the future.

Q. There are plans then for another meeting?

A. We're scheduling the next officer-committee meeting for Sept. 22-24. The idea is still on a tentative basis but, looking at the results of this week end, it seems to be a better way of conducting Society business.

Q. What committees will be asked to attend?

A. All those that have a pressing need to meet.

Gadget Ideas .....

Catch 'em

DO IDEAS THUNDER INTO YOUR HEAD as you push and squirm through crowds of people, do they pop into your consciousness as you ponder a problem in the plant, or do they roar from nowhere just as you are dropping off to sleep? Wherever they may emerge, don't let them get away, Catch 'em! They may lead to the invention of one of those ingenious and useful devices called a gadget.

Now especially is the time to start collecting ideas for entry in the 1961 Gadgets Contest. If you are an ASTME member you are eligible for the contest which runs from October 1 to December 31. And you don't even have to wait, send in those gadgets now, as many as you like, while the ideas are still flaming.

Hot ideas are worth cash! There is one first prize of $1000, plus two second prizes of $50, four third prizes of $25, and honorable mention awards going to close runners-up. Even entries that don't win prizes, but show information of use to other engineers, will be published in THE TOOL AND MANUFACTURING ENGINEER and honorariums paid for their use.

National Editorial Committee members will review all entries and judge them on the basis of their originality and their usefulness in modern manufacturing plants. Finished drawings are not required; pencil sketches or photographs are acceptable.

Remember, you can submit as many gadgets as you like, but limit each entry to 500 words. Mention your name and chapter affiliation on each page of the manuscript and each drawing to insure correct identification.

Members in the News

Previously with Proto Tool Co., Jamestown, N. Y., CLIFFORD BERGQUIST, chairman of Chautauqua-Warren chapter, has been appointed chief engineer of Proto-Tool's Los Angeles division.

Cincinnati chapter member WILLIAM L. DOLLE, JR. has been elected to the board of directors of Lodge and Shipley Co. Dolle presently serves as assistant to the firm's president and is primarily responsible for marketing and sales promotion.

R. R. WRIGHT, member of Houston chapter, has been named vice president of the air tool division of Cleco Air Tools Div., Reed Roller Bit Co. Wright joined Reed in 1939.

ROBERT T. EAKIN, Detroit chapter, is the new vice president of the engineering and construction division of Koppers Co., Inc., Pittsburgh, Pa. In this new position Eakin will be in charge of all his firm's activities in connection with the long-term management contract signed recently by Koppers de Venezuela, C. A. and Corporacion Venezolana de Guayana. Before joining Koppers earlier this year, Eakin was vice president of operations and a member of the board of directors at Latrobe Steel.

Micromatic Hone Corp. has announced the retirement of DONALD S. CONNOR, president and general manager since 1957. Connor, who is retiring due to ill-health, was also a member of the firm's board of directors for the past 17 years.

New vice president in charge of manufacturing at Burgmaster Corp. is JOHN A. MANDERS. Manders, formerly in charge of tooling, inspection and methods at Burgmaster, is a member of Centinela Valley chapter. Previously, he held technical and engineering positions with General Mills Corp.'s mechanical division and the Northern Pump Co.

Variety—Key to Long Island Activity

LONG ISLAND, N. Y.—Recent meetings of Chapter 88 well illustrate the variety of this group's activities. Early this spring Louis Golden and Joseph Kincaid of Grumman Aircraft Engineering Corp. gave a lecture on chemical milling with over 100 members and guests attending. A month later, the chapter represented ASTME in the second annual meeting of the Council of Long Island Technical Societies. Local groups of many technical societies such as AIIE, ASA, ASTME, and IRE, heard guest speaker Willy Ley, who is a widely known historian of rockets, space travels and missiles. Ley said that although the Russians have their heavy rocket now while our Saturn is two years away, the conquest of space will really begin when the two nations conquer the moon.

Early this summer Chapter 88 granted $125 scholarship awards to three technical institute students. During that same evening, ten awards totaling $400 were presented to winners of the chapter's high school design contest. —*W. Lamberta*

Louis Golden (left) and Joseph Kincaid (right) of Grumman, point out some features of a chemically sculptured part to John Hatter, past chairman.

Engineer Explains Guns

ROCHESTER, N. Y.—Rudolph Merz (front and center), vice president and chief engineer of Crosman Arms Co., explains the workings of a CO_2-powered rifle following a recent meeting of Rochester chapter. Merz, considered the pioneer inventor and developer of modern gas powered rifles and pistols, displayed an extensive array of guns.—*J. J. Valeska*

Connecticut Day

CHESHIRE, Conn.—Central Connecticut chapter this year hosted the 13th Annual Connecticut Tool and Manufacturing Engineers Day. Morning and afternoon plant tours, attended by over 200 persons, were followed by a technical session devoted to Cincinnati Milling Machine Company's Intraform process.

At a dinner meeting H. Dale Long, past ASTME national president, gave a short talk on the evening's main topic, "Meeting Foreign Competition." Rudolph Bannow, president of Bridgeport Machine, pursued the subject further by discussing tax problems in relation to the competitive market; inflation, its causes and cures; the dangers of centralized controls; and the effects of impulse buying on today's market. Some 400 attended the dinner meeting. —*Ebbie Thompson and J. H. Cameron*

First Groups Tour National Forge

IRVINE, Pa.—Members of Chautauqua-Warren and Bradford-Olean chapters are shown viewing the crankshaft machining division of National Forge. Due to the secrecy of the company's operations, these two groups were the first to tour the plant and inspect manufacturing procedures. —*C. E. Barrett*

special events

ASTME Seminar High Energy Rate Forming	Sept. 27-28 1961	Statler Hilton Hotel Detroit, Mich.
Hartford Chapter Seminar "Unified Screw Threads"	Oct. 3 1961	Hartford, Conn.
Wisconsin Council of Chapters' On-Campus Conference	Oct. 7 1961	Dominican College Racine, Wis.
ASTME Semiannual Meeting	Oct. 26-27 1961	Royal York Hotel Toronto, Canada

College and Industry

IOWA CITY, Iowa—Some 75 tool and manufacturing engineers attended the Seventh College-Industry Conference presented by Cedar Rapids chapter and the mechanical engineering department at the State University of Iowa.

Afternoon speaker Delmar Patersma, Maytag Co., presented the group with some thought provoking statistics on the scheduling, measurement and expense control of maintenance and toolroom activities. Too many companies, he said, are without a planning program for these departments, but Maytag found that, after putting their current program into effect, employee efficiency, which had been about forty percent, is now running 90-99 percent.

Other speakers at the conference were Allan Young of Collins Radio, who spoke on the machine tool evaluator's approach to numerical control; K. J. Trigger, professor of mechanical engineering at University of Illinois, who lectured on cutting tool wear; and Stanley Cope, president of the ACME School of Die Design Engineering, who told the group of a new approach in designing and building safety into metal stamping dies.

—Roy T. Sadler

To Strengthen the Society

BINGHAMTON, N. Y.—Chapters of New York state have initiated an annual ASTME Leadership Conference to strengthen the Society at the chapter level. Four participants in the first conference were (left to right) O. D. Lascoe, Purdue University; Sheldon Meyers, Long Island; Art Cervenka, national secretary; and Charles King, Binghamton. *—C. King*

. . . To Cool, Cool Aqua . . .

LITTLE ROCK Chapter 123 has smoked the peace pipe with postal authorities. At the request of the local post office, their monthly bulletin "Tool Tips" has gone from glow-in-the-dark red to a cool, eye-ease aqua. The glowing red will not return, says the chapter, until sunglasses are made a part of the postmen's standard equipment.

—David P. Finney

Scholarship Awarded

SPRINGFIELD, Vt.—At a combined meeting of Twin States and Monadnock chapters Richard Heller (right) received Twin State's $250 scholarship. He is being congratulated by Albert Gutterson, president of Lovejoy Tool Co. That same evening the group heard talks by Ralph E. Flanders, former U. S. Senator and ASTME honorary member, and David A. Schrom, national vice president. *—N. Gourley*

An Ounce of Prevention

ELMIRA, N. Y.—"The greatest deterrent to war is the Polaris submarine," said retired Naval Commander L. P. Hartung in a speech to Elmira chapter. Illustrating his talk with slides and motion pictures, he told the group that the Polaris is not a weapon for aggression, but rather a guarantee against an all-out atomic war.

Powerful and quick, the nuclear submarine with its sixteen atomic warhead rockets can destroy any target within a 1500-mile radius, and can be fired within minutes. As a result, all sixteen missiles can be launched before the first reaches its target. This happens in approximately 12 minutes. Another Polaris advantage is that, due to its nearly constant submersion, it is virtually impossible to detect.

—Henry Cunningham

Reports in Brief . . .

West Coast

SEATTLE chapter combined business and pleasure in a recent technical meeting. W. H. Yelland of Dyna-Systems, Inc., took care of business as he spoke on letting the tool decide, and Bryce Chambers of Hi-Fi Sales Co. spoke on the essentials of high fidelity and stereo, accompanying his lecture with a demonstration of equipment.

South

Frank Zager, president and general manager of Zager, Inc., spoke to LITTLE ROCK chapter at a recent technical meeting. His subject for the evening was multiple spindle drilling.

Midwest

DAYTON chapter recently honored its past chairmen at an education night meeting which featured Nicholas Engler as guest speaker. Engler, a professor at the University of Dayton, compared the Russian and American Satellite programs. . . . The Indianapolis 500 and midget racing highlighted INDIANAPOLIS chapter's annual Father and Son Night. Don Freeland, member of the Champion Spark Plug safety team, spoke on safe driving as it relates to the race track and also to the general public. . . . This spring ROCKFORD chapter held a double header technical program to cover the interests of both the tool and manufacturing engineer. Donald S. Behling, Porter Precision Products Co., spoke on ASTME standardized punches and E. J. Ritter, Cincinnati Milling Machine Co., gave a presentation on the practical applications of cutting fluids as applied to manufacturing operations.

Canada

S. G. Holdworth of Webster Air Equipment Co. was moderator at WINDSOR chapter's recent panel discussion on die casting. A film on pressure die casting was shown earlier in the evening.

position available

REPRESENTATIVES WANTED — Well-known and established company that recently acquired manufacturing and sales rights to established line of tools specified by tooling designers and sold to tooling builders, has open territories in eastern states available to reliable representatives who have a following in this field. Compensation will be straight commission. Give full description of your present operation, including lines you now handle and territory you cover. Write to Classified Ads, Dept. 217, 10700 Puritan Ave., Detroit 38, Mich.

positions wanted

A GRADUATE STUDENT FROM INDIA—working toward Master's Degree in Mechanical Engineering (completing Aug. 1961) at the University of Illinois, seeks position in a company manufacturing small or medium-sized machinery and accessories. Contact: H. M. Chawda, 402 E. Green, Champaign, Ill. Fleetwood 9-3648.

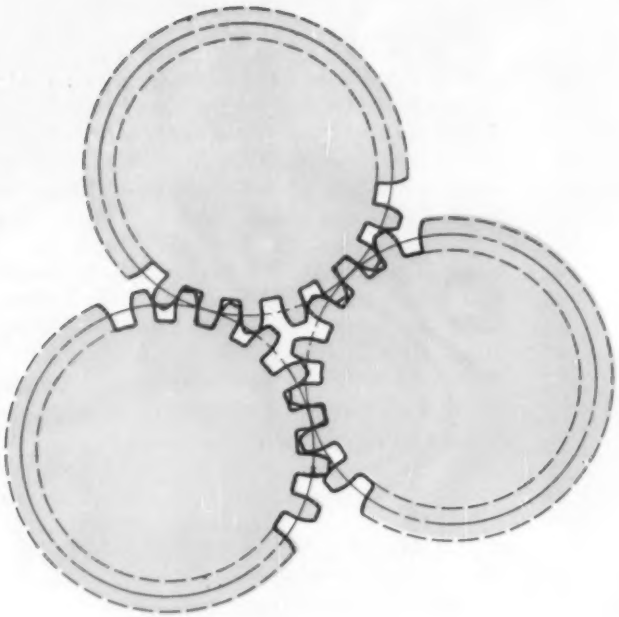
TOOL ENGINEER—with ten years' engineering experience, degree in industrial engineering, registered professional engineer. Desires tool engineering job with small manufacturing concern. Can also handle other engineering functions. Write to Classifield Ads, Dept. 214, 10700 Puritan Ave., Detroit 38, Mich.

PRESENTLY MANAGER—of manufacturing development. Eleven years with top company. Balanced experience and heavy responsibility all phases of industrial engineering, management, mechanical design, maintenance, and cost reduction. Strong organizer and planner that can get a job done. Well-qualified for position of plant manager or other executive duties. Write to Classified Ads, Dept. 212, 10700 Puritan Ave., Detroit 38, Mich.

MANUFACTURING ENGINEER—Highly diversified background. Twenty years' experience, manufacturing procedures, tooling, processing, plant layout, cost reduction, plant supervision, estimating, purchasing, industrial sales, job-shop type operation, or volume production. Practical shop background as tool and diemaker. Technical education. Interested in challenging position with medium to small progressive company. Will relocate. Write to Classified Ads, Dept. 213, 10700 Puritan Ave., Detroit 38, Mich.

SALES ENGINEER—to be associated with sales engineering or technical sales of a manufacturer in United States and represent them in Canada on machine tools or technical products. Twelve years' experience in operating branch office, representing company through correspondence, preparing preliminary quotations for engineering, presenting formal quotations to management. Developed excellent customer relationship. Resume upon request. Write to Classified Ads, Dept. 215, 10700 Puritan Ave., Detroit 38, Mich.

TOOL DESIGN TECHNICIAN—with 12 years' experience teaching auto mechanics and welding courses seeks employment with mass-production organization. Specialized in tool design, welding and holds B.S. degree in education. Write to Classified Ads, Dept. 216, 10700 Puritan Ave., Detroit 38, Mich.



What's Your Mechanical I. Q.?

Chances are it's pretty high if you spotted the impossibility of this gear train immediately. And even if you had to do a double-take to see it, you're still probably a natural mechanic. If you had to read to this point to find out that the gears illustrated can't possibly turn . . . well, most likely you've got talents that point to other fields.

No matter what category you're in, we'd like to remind you that the Gadgets Contest starts October 1 and that we're most anxious to see your entry. You've probably got some excellent ideas that you've mentally filed and perhaps forgotten . . . ideas that might win you a prize. Why not get these potential money winners down on paper and enter them in the 1961 Gadgets Contest? A brief description in your own words —500 words or less—will do.

Entries will be judged on the basis of originality, conciseness and completeness. Finished drawings aren't necessary—rough drawings that adequately convey your idea are fine.

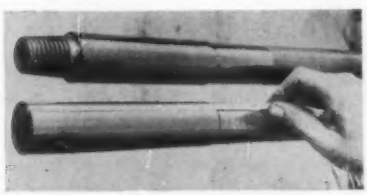
First prize will be $100. Two second prizes of $50 and four third prizes of $25 will also be awarded. All close runners-up will receive honorable mention awards and copies of either *The Tool Engineers Handbook* or *The Die Design Handbook*.

Because the contest closes December 31 and because the holiday season and its distractions will soon be upon us, we urge you to submit your entries at the earliest possible date. Send them to the Gadgets Editor, THE TOOL AND MANUFACTURING ENGINEER, 10700 Puritan Ave., Detroit 38, Mich.

Progress in Production

FRICTION WELDING JOINS TOOL JOINTS AND TUBING

For the first time in the free world, friction welding—a process developed in Russia in 1957—has been used to fill an industrial order. This process uses the heat created by rotating or sliding



These 1¼-inch male and female tool joints were friction-welded to 30-ft lengths of 1¼-inch tubing at the rate of 20 welds an hour.

the two objects against each other at high speeds and low pressures to effect the weld.

The production run took place at American Iron & Machine Works Co., Inc. Approximately 15,000 linear feet of tubing and 1000 welds were involved in welding small-diameter tool joints to 1¼-inch-diam tubing. This tubing is used for servicing wells to assist in oil production and recovery by drilling inside 2⅞-inch-diam tubing contained within cement-encased wells.

Prior to this job, thread and coupled pipe has been used. However, such couplings are inherently deficient in design and durability for many drilling operations. The tool joint allows drillers a new freedom and flexibility in using small size pipe because of its greater strength.

Cost data compiled during the production run indicates that the new friction welded joint is competitive with threaded and coupled joints and with pressure-welded joints. Friction welding's speed made a decided contribution to the low cost. The prototype machine used for the job averaged 20 welds an hour, with runs of 27 an hour occurring frequently. This is comparable in speed to flash welding and far exceeds that of pressure welding and other more widely used methods.

CONTINUOUS VIBRATORY FINISHING SAVES TIME, SPACE, LABOR

With the installation of a new parts finishing system, Sportsman's Golf Corp., Illinois manufacturer of golf clubs, has achieved a substantial reduction in finishing costs and a quality improvement.

The finishing operations are performed on golf club heads. These are steel forgings that must be cleaned up and given a smooth finish prior to plating. In the past, the flash from the forging operation was ground off manually, the forgings were marked and then were tumbled in conventional type finishing barrels for a 24-hr period. Tumbling was followed by hand buffing operations.

Aluminum oxide chips were used for the tumbling operations, which were performed in three 45 x 36-inch two-compartment machines. Capacity with this equipment was 3000 club heads per day. Cost was about 5 cents per head, exclusive of hand buffing operations.

Early this year, the conventional barrels were replaced by a vibratory finishing machine—the Mediamatic Vibratron—designed and manufactured by Roto-Finish Co., Kalamazoo, Mich. This machine has two 25-cu ft tubs in which finishing operations are performed. At the start of the finishing cycle, parts and media ("chips") are evenly distributed into the two tubs. Parts and media automatically circulate through both tubs during the finishing cycle, traveling from the first tub to the second tub and from the second tub back to the first tub on conveyors until processing is completed. Removable baffles direct the load from

Continuous automatic vibratory finishing machine. The machine has two tubs. Parts and media circulate through both tubs until five-hour processing cycle is completed, passing from tub to tub on the conveyor in front of machine operator.

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- Drill any shaped part to any depth (sometimes interrupted holes or across existing holes).
- Drill shallow or deep holes to precision tolerances.

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tub to tub during the finishing cycle. On completion of the cycle, the baffle at the end of the first tub is removed. A magnetic separator picks up the finished heads, directing them into a container.

Parts and media are continuously rinsed to remove metal and small abrasive particles. The media are continuously screened to remove undersize media. Triangular media are used, measuring 1¼ inch on the sides and ¼-inch thick. Approximately 1800 lb

Stages in production of golf club head. Head at left is in the forged-and-marked condition; head in center has been finished in the vibratory machine; head at right has been buffed and plated.

of media and 1600 club heads are in the machines at all times during the processing cycle. The cycle is five hours, with one hour required for loading and unloading. Daily capacity is 6500 parts per hour on a three-shift basis.

Total direct finishing costs are about the same for the vibratory machine as for the previous method of operation. Due to the better finish obtained with the Vibratron, however, less subsequent buffing time is required, resulting in a penny-per-part or $65.00 per day saving.

Reduced material handling and labor requirements result in additional savings. Also, since the Vibratron machine is much more compact than conventional equipment for finishing an equivalent amount of parts, floor space savings are substantial.

MECHANICAL PLATING CURBS CORROSION

Mechanical plating—a process used for some time for zinc plating jobs—is being used successfully for applying cadmium coatings to lock washers. The process eliminates one of the major problems faced by users of lock washers—hydrogen embrittlement.

Developed by Minnesota Mining and Manufacturing Co., the process involves cleaning the parts; adding a powdered plating metal, a promotor chemical and impact media, which are glass particles; and covering the charge with water. The barrel is rotated for 45 min., during which the glass particles consolidate and cold weld the metal into

a dense, continuous and adherent coating. When the cycle is completed, plated parts are separated from the impact media, which is washed for re-use.

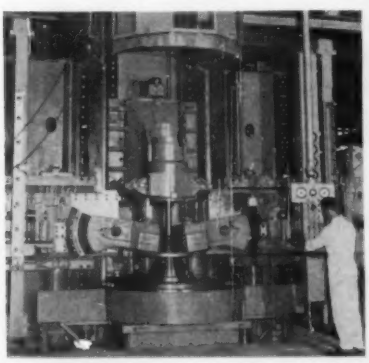
The Mellowes Co., manufacturers of lock washers, has found that mechanical plating deposits a much thicker coating of cadmium than electrolytic plating does at the same cost. Thickness of the plate is controlled by the quantity of metal powder added to the tumbling barrel.

The method is especially suited for mass-plating small metal parts and assemblies, some of which could not be plated successfully by other methods because of design factors. Alloy coatings can be applied as simply as pure metals.

SHEARFORMING MACHINE MAKES MISSILE PARTS

Nose cones, helicopter rotor pylons, center sections for missiles, nose and flare sections and adapter cones for reentry vehicles, diffusers, rocket case cylinder sections, bulkheads, liquid propellant missile support cones and elliptical rocket chamber heads are examples of missile and aircraft components to be fabricated on the vertical machine pictured here.

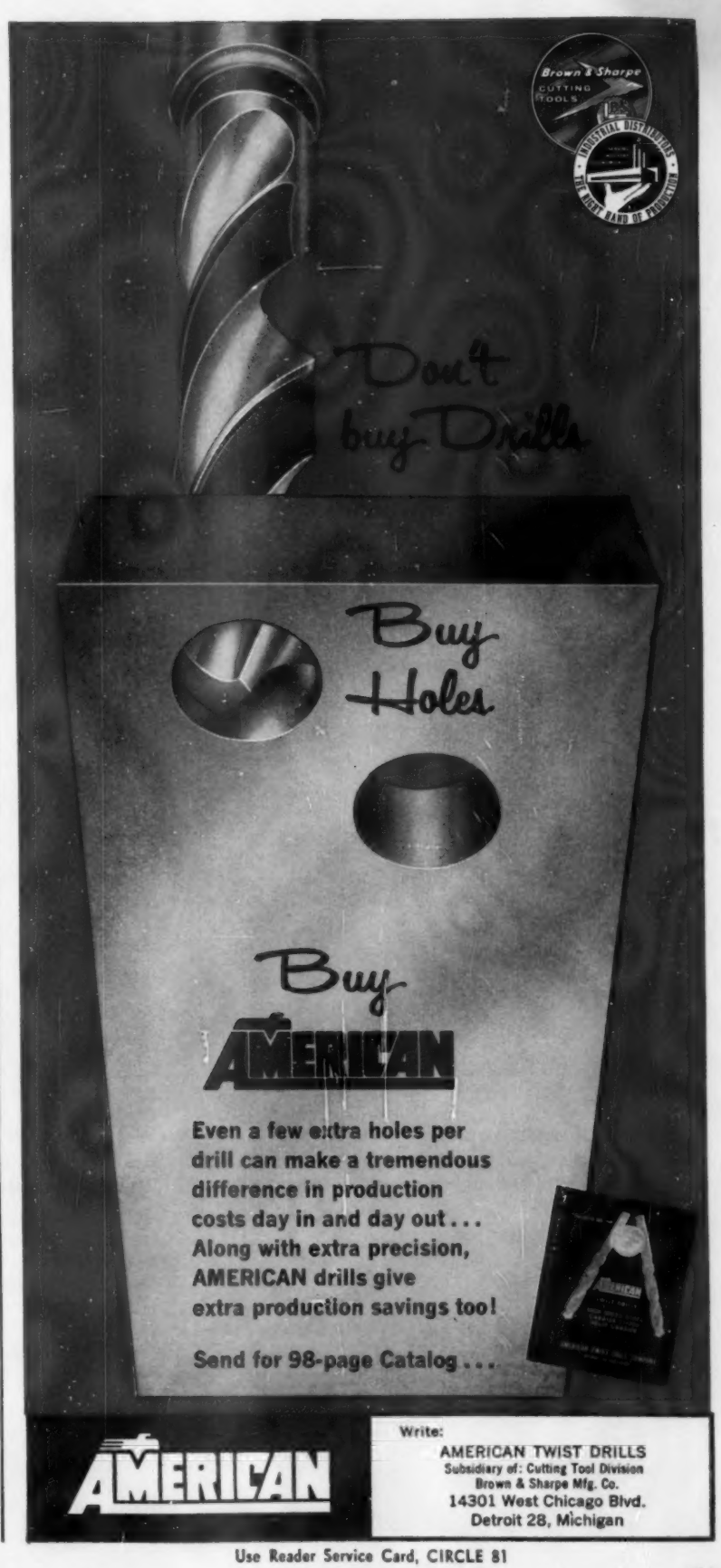
Substantial savings in material and man-hours achieved through use of a smaller model—a horizontal machine adapted to accommodate parts up to 60 inches in diameter—led Avco Corp.'s Lycoming Div. to install this machine. Built by Cincinnati Milling Machine Co., the Hydrospin machine is capable of shearforming parts up to 72 inches



Parts with diameters up to 72 inches are fabricated on this shearforming machine.

in diameter and to a finish length, in tube spinning, in excess of 144 inches.

The machine can be readily equipped with attachments for forming magnesium alloys, titanium, molybdenum and other metals requiring heat. Maximum starting black thicknesses are $\frac{5}{8}$ inch for stainless steel, $\frac{3}{4}$ inch for mild steel and $1\frac{1}{4}$ inch for aluminum or brass.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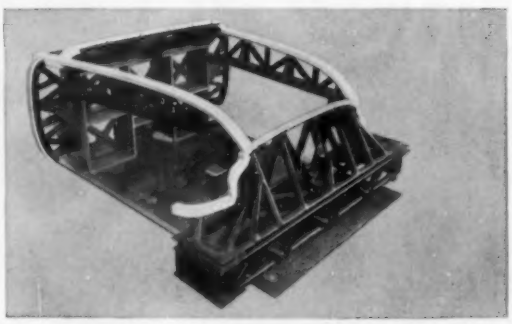
TOOLING DELIVERY SCHEDULES

This aircraft hydroform die, mass cast from REN epoxies, saved six weeks in delivery time. It was originally quoted in steel at $10,000, 8 weeks delivery. Using REN epoxies, it was delivered in 10 days for less than $3,000.



Automotive front end alignment checking fixture fabricated from REN epoxies, glass cloth and tubing was built in 8 weeks. Former method required 3 to 4 months delivery time.

Time savings up to 70% provide scheduling flexibility that permits easier, quicker design modifications

REN plastic tooling has taken the pressure off many tight production schedules in the automotive, aircraft, appliance and other metalworking industries. The savings in time and cost shown here are typical.

You can depend upon uniform materials, precisely formulated by REN. Dimensional stability and compressive strength are assured. There's "Nothing to Chance" with REN materials—the complete line of epoxies and accessories for maximum tooling savings.

Versatile REN epoxies save time and cut cost of tools, dies, jigs, fixtures, master models and foundry patterns

REN materials present new dimensions in design and production. From model through prototype and production stages, they provide greater latitude in time, cost and creative engineering.

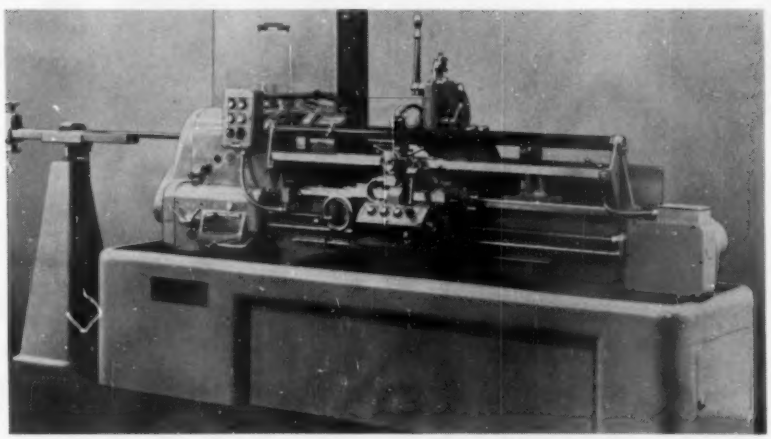
Published periodically, the REN TECH-NI-TIPS/TOOLING DIGEST can supply you with complete, up-to-date information on the techniques of application of plastic tooling. If you are not already receiving this valuable information, write for your free subscription.

Write department 61-2

ren plastics, inc. 5656 south cedar street, lansing 9, michigan

TOOLS of today

Machine Has One-Pass Turning

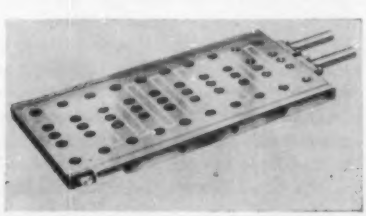


Contour turning of round, square and hexagon bar stock is the function of the Trace-O-Matic centerless shaft turning machine. It has a rotating bar stock support that is adjacent to, and travels with, the turning tool. Because of the proximity of the bar stock collet support to the turning tool throughout the entire turning operation, all need for the tailstock center is eliminated. Bar stock lengths up to 40 inches can be machined in one pass and, if the finished parts are sufficiently short, two or more parts can be produced in one pass from duplicate or dissimilar templates placed end to end.

Taber Instrument Corp., 111 Goundry St. N. Tonawanda, N. Y. **Circle 401**

Surfacing Plate Decreases Distortion

This surfacing plate is an accessory for magnetic chucks and is used where distortion caused by magnetism is a problem. It has several plungers, which can be quickly set to support a workpiece so that it can be machined in its natural, undistorted state. When the magnetic chuck is turned off, the piece remains as machined.



Homestrand Machine Tool Corp., 392 W. Putnam Ave., Greenwich, Conn. **Circle 402**

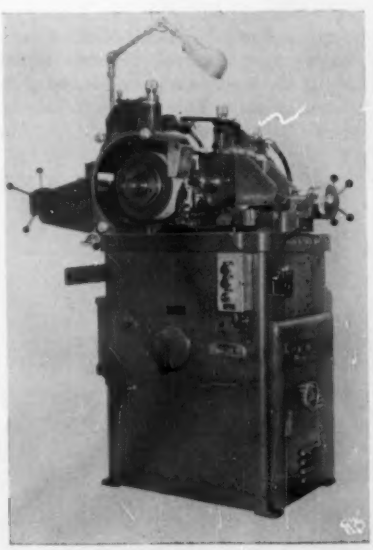
Torque Wrench Records Peak Readings

Determining the maximum torque which a nut, bolt or screw will take before its elastic limit is reached and the fastener suddenly yields or snaps is simplified with this torque wrench. Its pointer, made of acetal resin, is pushed along a track on the face of the scale as torque is exerted. Enough tension is built into the indicator to insure its remaining at the end of each test at the place where peak torque was exerted.

P. A. Sturtevant Co., Addison, Ill. **Circle 403**

Machine Grinds Multiple Diameter Parts

Model CG-12 centerless grinder has a permanently mounted crush dresser designed for through feed, plunge feed and infeed grinding. Measuring 24 x 48 inches, the machine grinds multiple-diameter parts and intricately shaped profiles. It can grind materials such as tungsten carbide, stainless or carbon steel, glass and plastic—to 0.0002 inch tolerances and 6 to 8 microinch finishes. It also grinds wood, nonferrous metals, fiber, hard rubber, ceramics and cork. Both sides of the wheel are accessible



from the operating position and the wheel dresser can be either manually or hydraulically operated.

Royal Master Grinders, Inc., 272 Highway, Riverdale, N. J. **Circle 404**

Small-Parts Feeder Is Versatile

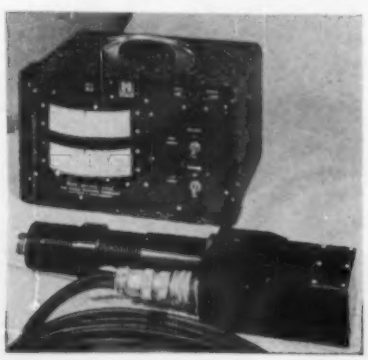
One feature of the TransfeRobot parts feeder is its interchangeable parts orientation segment. The machine, which automatically feeds, orients and dispenses small parts of various sizes and

shapes, is available with two bowl sizes —18 and 24 inches. Each bowl size has five segment designs. Because of the interchangeable segments, the feeder can be quickly converted for various feeding and orientation jobs. The static control for the vibratory motor has built-in compensation for line voltage variations.

U. S. Robodyne, Div. of U. S. Industries, Silver Spring, Md. **Circle 405**

Tool Setting Gage Needs No Physical Contact

Location of tool points within 0.000025 inch in relation to the workpiece is possible with the Tool-Tronic tool setting gage. A combination optical and electronic device, the gage consists of a gage-sensing head mounted vertically over the tool position which houses the light source lenses and photo-sensing cells. This unit is connected electrically to a reading cabinet housing an electronic amplifier power supply and two tool location indicating meters.



Tool point damage sometimes associated with the touch or contact method of tool setting is also eliminated since no physical contact is made with the tool point itself.

Heald Machine Co., Worcester 6, Mass. **Circle 406**

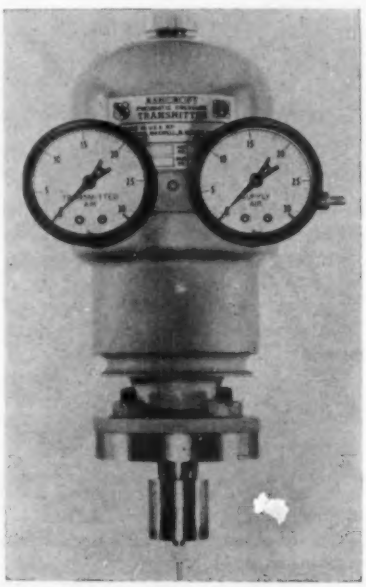
Transistorized Relay Needs No Warm-Up Time

High impedance input for stop motion, inspection, sorting and positioning of machinery is provided by this transistorized sensitive relay. The advantage of the transistorized relay over the vacuum tube relay amplifier is that it needs no time for warm-up. The relay is rated at 10 amp, 300 volt, a-c. It has double pole, double throw contacts.

General Electric Co., Schenectady 5, N. Y. **Circle 407**

Motion Transmitter Monitors Operations

This pneumatic motion transmitter, designed to transmit linear motion as a pneumatic signal for indication on a remote receiver gage, can be installed on machines and tooling setups to send



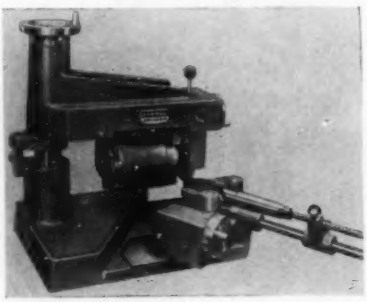
continuous checking information to a central control station. Motion is sensed by the valve-actuating rod which, in turn, causes a change in output air pressure. Thus, a pneumatic output signal directly proportional to the motion is available for control. The instrument uses either a 3 to 15 psi or 3 to 27 psi output signal, with supply air requirements of 18 to 20 psi and 30 to 35 psi.

Manning, Maxwell & Moore, Inc., Stratford, Conn. **Circle 408**

Drill Point Thinner Renews Worn Drills

Drill points with diameters of ½ to 3 inches in lengths up to 24 inches can be thinned and centered with this compact, bench type, self-contained, motor-driven unit. The drill is held by hardened jaws on the leading edges of the flutes; just back of the cutting edges; and by an adjustable center at the end of the shank. This three-point grip leaves the body of the drill entirely free of any contact with the chuck.

The machine grinds a groove of the



proper depth on each side of the web. This reduces the length of the flat between cutting edges, which has a tendency to thicken as the drill wears. The machine is equipped with a ½-hp, 3450-rpm motor.

Farrel-Birmingham Co., Inc., 565 Blossom Rd., Rochester 10, N. Y. **Circle 409**

Tool Doubles as Tap, Drill Holder

This drill and tap holder—the Tap-Leader—permits power feed tapping operations on horizontal and vertical spindle machines not equipped with thread leads or not having leads that

USE READER SERVICE CARD ON PAGE 163 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

match those of the tap. It also absorbs backlash in the machine feed gearing when the tap is reversed. Available in two models, it handles taps from ¼ to 1¼ inches in diameter. Maximum depths of full thread range up to 2 inches. The holder has quick-change collets and chucks and a float-lock arrangement to convert the tool from a tap to a drill holder. For tapping operations where the machine feed rate is less than the tap lead, a sliding adapter sleeve working against a large spring in the tool body lets the tool stretch, freeing the tap of excessive torsional and longitudinal stress loads. Where ma-

chine feed is greater than tap lead, excessive spindle feed is absorbed by the sliding adapter sleeve which contracts, compressing a second spring in the tool body.

Davis Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. **Circle 410**

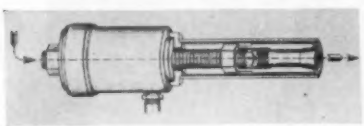
Silicon Units Convert A-C Power to D-C

Virtually every industrial application requiring d-c power can be met with one of the silicon d-c power supplies. Available in ratings from 0.75 kw to 75 kw, the line is divided into three basic industrial rectifier groups—general purpose units, essential service units and synchronous motor field excitation units. The convention-cooled power supply units utilize current-limiting fuses to protect the silicon cells against faults on the load and source side of the equipment. Operating efficiency of the rectifier units is nearly constant at 96 percent from ¼ to full load for units rated 25 kw and higher while, below 25 kw, efficiency decreases gradually to approximately 95 percent.

General Electric Co., Schenectady 5, N. Y. **Circle 411**

Unit Extracts Pins, Tubes

Removal of all pressed dowel and guide pins, bushings, studs, shafts and tubes—regardless of length—is made easy with the pin and tube extractor. A center hole runs its entire length. Ten tons of hydraulic power are available from a finger tip remote control



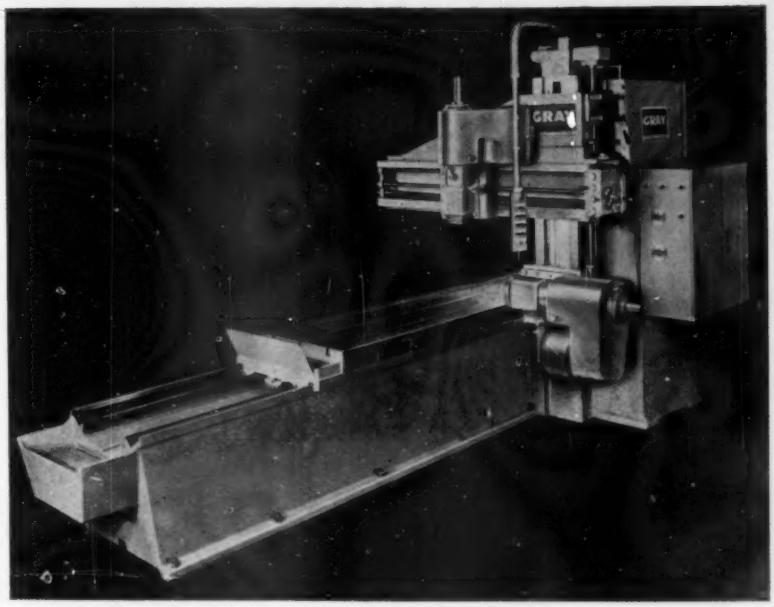
pump. Round and threaded collet sizes are ordered separately for either the manual or hydraulic model.

Wright Tool Co., 4316 N. Woodward Ave., Royal Oak, Mich. **Circle 412**

Need Information Fast?

If you need information on machines, tools, tooling, manufacturing equipment of any kind, consult the Manufacturing Engineering Information Services section of THE TOOL AND MANUFACTURING ENGINEER's March 15, 1961 issue. Fifteen hundred product classifications are covered, and 2000 national sources and 21,000 local sources of information on these products are listed, with names, addresses and telephone numbers.

Milling Machine Handles Production, Shop Jobs

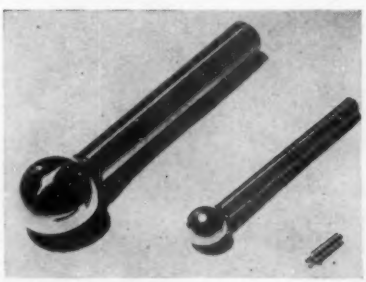


Available in 30, 36 and 42-inch models, the Handymill—an open side milling machine—handles production work as well as everyday shop jobs. One feature is its milling head to which standard attachments may be added. Powered by a 10-hp motor, the machine operates at eight speeds from 67 to 652 rpm and with feeds from 1 to 40 ipm.

G. A. Gray Co., Cincinnati 7, Ohio. **Circle 413**

Tooling Balls Have 0.000050-Inch Accuracy

Concentricity of ball to shank of these tooling balls is accurate to 0.000050 inch TIR, ball roundness to 0.000010, ball diameter to ±0.000020 and ball finish to 1 and 2 microinches. The balls



utilize a two-piece construction with the balls welded to the shank and designed to fracture rather than bend. Thus, the accidental use of bent and inaccurate tooling balls is checked. The ball and shank are hardened to 45 R_C minimum.

Emmco Development Corp., 784 Carroll St., Brooklyn 15, N. Y. **Circle 414**

Gear Analyzer Detects Small Nicks

Three measurements of gear tooth accuracy—work gear tooth eccentricity, tooth-to-tooth variation and tooth oversize and undersize conditions—can be made simultaneously with this rolling fixture gear analyzer. Its three electrical indicators detect nicks on tooth profiles as small as 0.0005-inch high. The inertia type gear analyzer has a pivoted motorized master gear that is meshed with the gear to be inspected and rotated. Measurements of the center distance movements are transmitted to a panel unit where a red light shows a reject gear. At the same time another light shows the particular error that caused the rejection. A large dial in the panel unit gives visual indication

of the eccentricity measurement. Another control on the panel permits adjustment of master gear rotating speed.

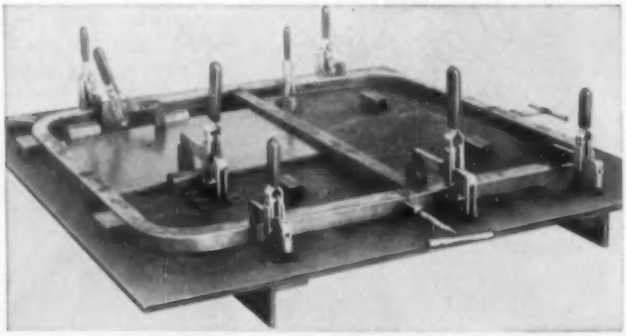
National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich. **Circle 415**

YOU CAN HAVE PRE-PLANNED PRODUCTION

DE-STA-CO

WITH DE-STA-CO TOGGLE CLAMPS

De-Sta-Co makes it easy to pre-plan production jigs and fixtures right on the drawing board! Detailed tracing templates, in full and half size, can be slipped under a drawing and spotted accurately—saves design time, speeds fabrication! Choose from over 140 models, there's a clamp for every job.



Steel welding fixture with 8 De-Sta-Co Model 267 Toggle Action Clamps holds parts securely during fabrication.

HOLDING PRESSURES FROM MERE OUNCES TO 16,000 POUNDS
FOR DETAILS—ASK FOR NEW 36-PAGE CATALOG

TOGGLE CLAMPS
SHIMS AND SPACERS
DE-STA-CO
STAMPINGS
BLOWER HOUSINGS

DETROIT STAMPING COMPANY
340 MIDLAND AVENUE • DETROIT 3, MICHIGAN

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TOOLS of today

Unit Drills Burr-Free Printed Circuit Holes

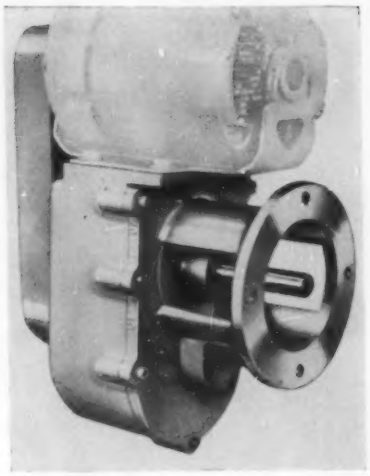
Lending itself to both long and short run production jobs, the Quad-Drill can drill as many as 25,000 holes an hour in printed circuit boards. Hole location is maintained within 0.001 inch of template position. The unit is a free-moving coordinate axis machine which permits two-directional positioning of a central drill head over desired locations. The drill head has four spindles, each located on the corner of a 10-inch square, allowing four stacks of 10 x 10-inch boards to be drilled at one time. Each spindle is equipped with a drill bushing pressure foot which applies a compressive force of 75 lb to the circuit boards before the drill enters the work. The drill stroke speed is adjustable from zero to 35 ipm and drill speed from zero to 21,000 rpm.

USE READER SERVICE CARD ON PAGE 163 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Excellon Industries, 5002 Crenshaw Blvd., Los Angeles, Calif. **Circle 416**

Speed Reducer Has 900:1 Ratio

Although designed to operate on a polyphase motor, this spur gear speed reducer can be used with a 110-volt, single-phase, small-horsepower motor. To facilitate reducing or increasing the speed ratio, the reducer has a belt and pulley. The reduction unit has a 450:1 gear ratio and the belt has a 2:1 ratio,

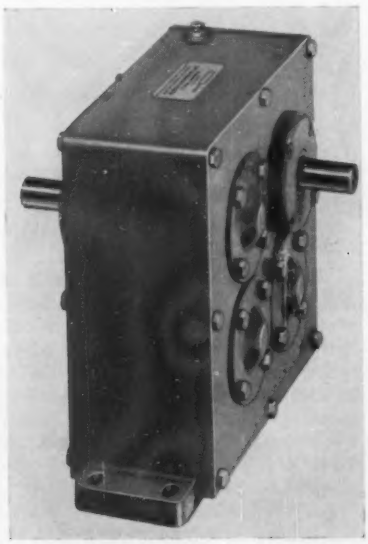


providing an over-all reduction of 900:1. The reducer provides ratios of 450:1 with a 1750-rpm motor and a 1:1 pulley ratio, and a 900:1 reduction with a 1750-rpm motor and a 1:2 pulley ratio. The unit can be mounted either vertically or horizontally.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill. **Circle 417**

Drive Provides Smooth Intermittent Motion

Designed to provide a smooth acceleration-deceleration motion, the Dwel-Drive can be attached to packaging units, indexing tables, metalworking machines and punch presses. This intermittent motion drive is also designed to eliminate shock loads on single revolution clutches because of its output shaft which makes one complete revolution for each complete revolution of the input shaft. Both models—one with a 40-deg dwell and the other with a 140-deg dwell—have a maximum working torque

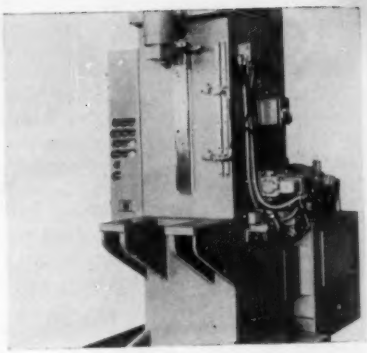


of 50 ft-lb. Both models are square-shaped, measuring 9¾ inches square. The small model has a thickness of 4⅜ inches and the large model, 7⅛ inches. The shaft protrudes 1¾ inches.

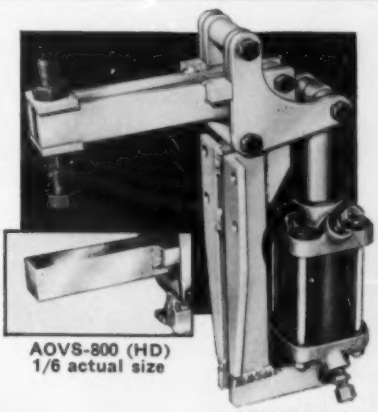
Remmele Engineering, Inc., 515 University Ave., St. Paul, Minn. **Circle 418**

Broaching Machines Have High Speeds

Designed primarily for automated operations, the GBP series press type broaching machines are available in six



DON'T SEND A BOY TO DO A MAN'S JOB— SPECIFY *KNU-VISE* NEW *VERTICAL CYLINDER* CLAMPS



AOVS-800 (HD) 1/6 actual size

AOV-800 (HD) 1/6 actual size

Tough, rugged and designed to do a man-sized clamping job—that's the *new* line of *vertical cylinder* air or oil operated clamps now being manufactured by Lapeer Knu-Vise.

The all new Heavy Duty AOV Series, features three basic sizes of 200, 400 and 800 lbs. clamping force respectively. Each size may be specified with either solid (inset) or channel toggle bars and spindle assembly (top).

Like all Knu-Vise products these powerful new vertical cylinder heavy-duty clamps were designed to give outstanding performance under the toughest manufacturing conditions. Such features as HARDENED AND GROUND BEARING BOLTS . . . HARDENED STEEL BUSHINGS . . . SELF-LOCKING NUTS FOR "TAKE-UP OF PLAY" . . . TOGGLE BARS MADE FROM COLD ROLLED STEEL . . . and EASY PARTS REPLACEMENT all assure you that when you specify Lapeer's KNU-VISE PRODUCTS you're "sending a man to do a man's job." Write today for complete information.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS

LAPEER MANUFACTURING CO.

3053 DAVISON ROAD
LAPEER, MICHIGAN

WESTERN DIV.: PECK and LEWIS CORPORATION
4436 Long Beach Ave., Los Angeles 58, Calif., ADams 3-7146

CANADIAN DIV.: HIGGINSON EQUIP. SALES LTD.
1131 Pettit Road, Burlington, Ontario

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models with capacities ranging from 4 to 15 tons and with a stroke span from 22 to 36 inches. Three of the models operate at broaching speeds up to 50 fpm. All models have a four-way guided ram. Open-knee platen and pot type chambers provide easy installation of automated loading and unloading equipment.

General Broach and Engineering Co., Detroit 38, Mich. **Circle 419**

Vapor Cleaner Handles Electronic Parts

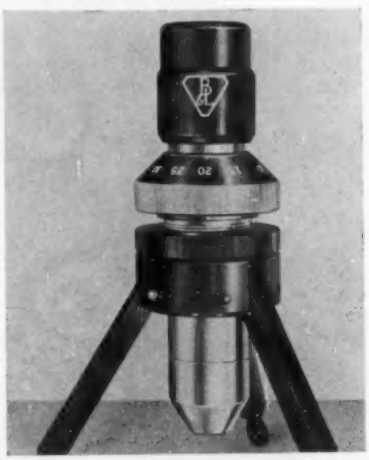
Originally developed for one-step batch cleaning of transistors, the Vatron 120 can be used also for other electronic components, printed circuitry, instruments and machined parts. Vapor cleaning is combined with a simulataneous flushing action of solvent condensate raining down on the work from the unit's lid condenser. Carry-out of contaminates on the work is eliminated because cleaning is accomplished in the

unit without the work coming in contact with contaminated solvent. Flushing and rinsing of the work with pure solvent condensate can be continued as long as desired.

Currier Co., 511 O'Neill Ave., Belmont, Calif. **Circle 420**

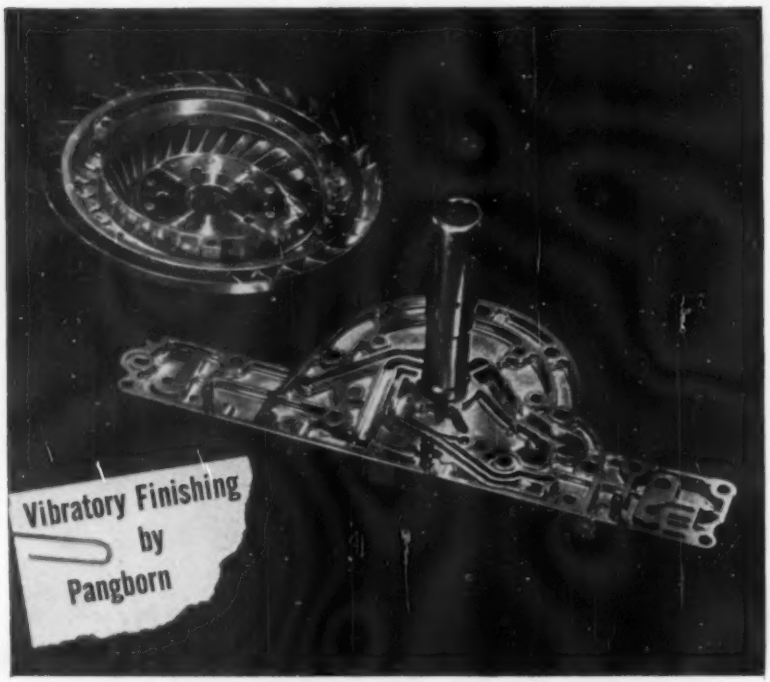
Zoom Macroscope Gives Direct Readings

Features of this lightweight zoom macroscope for quick, on-the-spot examination or measurement of parts include an automatic prefocus gage, tripod leg construction for greater portability and a special optical system which



provides continuous magnification from 10X to 30X. Zoom optics allow the operator to vary magnification over the entire range of the instrument by rotating the power changer ring. The instrument maintains constant focus regardless of subsequent power changes. Field of view is 0.420 inches at 10X and 0.240 inch at 30X. The instrument is supplied with a crossline reticle.

Bausch & Lomb Inc., 76361 Bausch St., Rochester 2, N. Y. **Circle 421**



Suddenly complex finishing has a simple solution!

The Pangborn Vibratory Finishing Machine has an unusually wide range of application. What would you like to descale, deburr, radius, finish or burnish?

Metal and metal alloy as well as many plastic and ceramic parts may be vibratory finished. This machine processes extremely small and delicate items with the same facility it handles large and heavy objects.

What's more, the Pangborn Vibratory Finishing Machine performs as much as 100 times faster than conventional equipment. Cuts costs? You bet!

All sizes of the machine come equipped with variable speeds and amplitudes plus new improved air-cushioned suspension. Optional air-cushioned floor mounts completely eliminate any transmission of vibration to the floor. Auxiliary equipment and the best in media and compounds are available for your every need. Send parts with exact finish specifications or finished specimen for sample processing in our laboratory to Mr. William E. Brandt at:

PANGBORN CORPORATION, 4700 Pangborn Blvd., Hagerstown, Md.; Pangborn Canada Ltd. 47 Shaft Rd., Toronto (Rexdale), Canada — *Manufacturers of Vibratory Finishing, Blast Cleaning, Dust Control Equipment — Rotoblast® Steel Shot and Grit®.*

Pangborn
OF HAGERSTOWN

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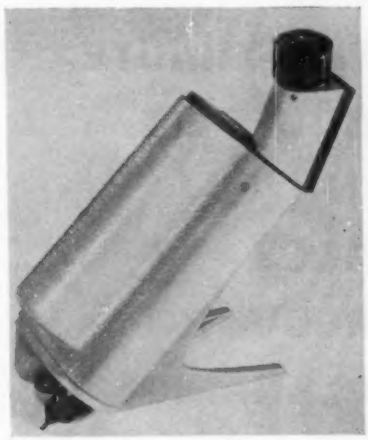
Microscope Detects, Measures Die Wear

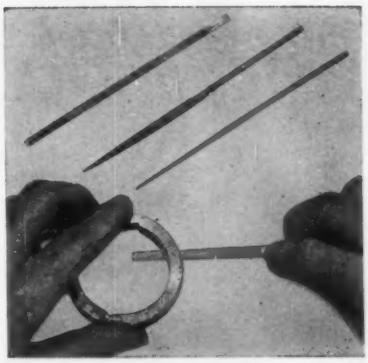
With the Die-Wear microscope, it is possible to determine the exact amount of metal which must be ground away to properly resharpen the cutting edge of metal dies. It is capable of measuring die wear over a range of 0.020 inch to an accuracy of ±0.0005 inch or 10 percent of the depth, whichever is greater. It can also be used for measuring bevels, burrs and fillets. A guide at the front of the instrument contacts the die edge to be measured, automatically positioning the microscope for best viewing. The guide can be used in holes as small as 3/32 inch in diameter or slots 3/16 inch wide. The instrument is available as a battery-operated unit or with transformer for use from 115-volt, 60-cycle, a-c outlets. The base of the unit can be removed when it is more convenient to hold the instrument by hand.



Bausch & Lomb, Inc., Rochester 2, N. Y. **Circle 422**

Diamond Needle Files Cut Hard Metals

These diamond needle files are particularly well-suited to sharpening, cutting and dressing hardened steel dies, carbide and ceramic materials. They have found extensive use in dressing hard nitrited dies for extruding aluminum. They are available in 12 different shapes and as slot files or machine files. They are made in three grits—200/240, fine, for polishing; 120/160, medium, for general use; and 80/100, coarse, for rapid material removal. Since there is virtually no wear associated with the use of hard diamond, objectionable dust from bonded abrasive bars is not a problem.



Titan Tool Supply Co., Inc., 68 Comet Ave., Buffalo 16, N. Y. **Circle 423**

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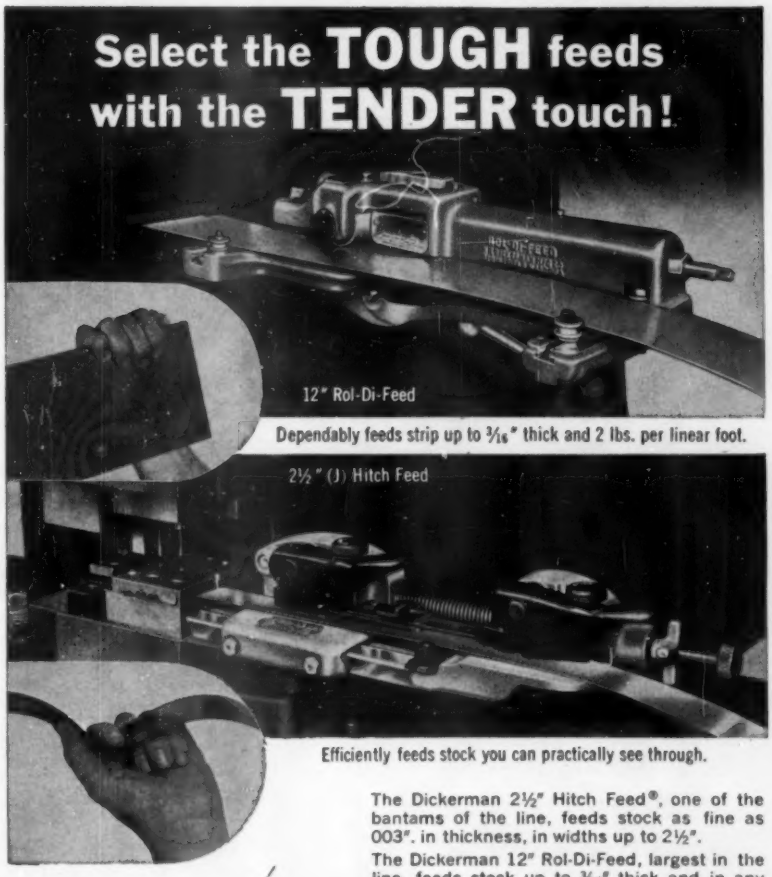
Modular Looper Makes 4200 Springs an Hour

This modular spring looper can be used as either a semiautomatic or automatic high-speed machine for independent operation or in combination with other spring coiling machines. It can form all types of loops on springs with

Why Dickerman punch press feed users—


Select the TOUGH feeds
with the TENDER touch!
12" Rol-Di-Feed
Dependably feeds strip up to 3/16" thick and 2 lbs. per linear foot.
2½" (J) Hitch Feed
Efficiently feeds stock you can practically see through.

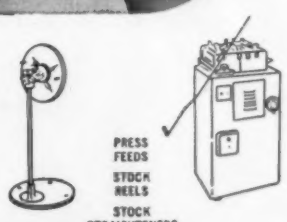
The Dickerman 2½" Hitch Feed®, one of the bantams of the line, feeds stock as fine as 003". in thickness, in widths up to 2½".

The Dickerman 12" Rol-Di-Feed, largest in the line, feeds stock up to 3/16" thick and in any width up to 2 lbs. per linear foot.

There are 15 "standard" feeds in the complete, versatile Dickerman line.

They all feed as fast as it is wise to run the tooling . . . and a hundred-million pieces, without major maintenance is routine.

You can gently feed a small fraction of an inch with a "Hitch Feed" or you can accurately position big, rugged strip stock up to 12" per press stroke with the Rol-Di-Feed.



Versatile, Dependable Production Savings are the reasons for specifying Dickerman Feeds. Prove it to yourself.

Dickerman

H. E. DICKERMAN MFG. CO.
105 Albany Street • Springfield, Mass. Send for literature and prices

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YOU ARE INVITED TO TAKE OUR FIVE-MINUTE COURSE IN COST REDUCTION PLANNING

R.S.V.P.
EMHART MFG. CO.
HUDSON DIVISION
HUDSON, N.Y.

EMHART

IN INVITING YOU TO TAKE OUR COURSE . . .

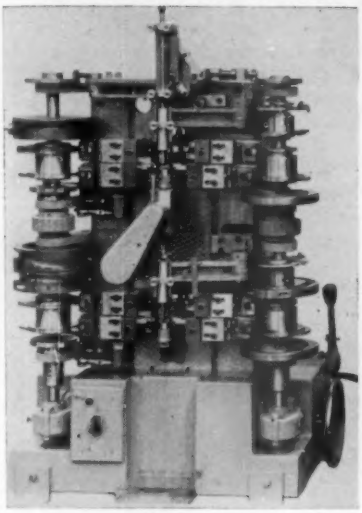
May we stress that, while we make precision V&O presses, feeds and automatic assembly machines, we are really in the business of helping you effect cost reductions in small parts production.

You can take our course by simply asking us to have the Emhart man in your area call on you. He is prepared to discuss cost reduction in the following areas . . .

1. PRODUCT DESIGN
2. MATERIAL AND PARTS FLOW
3. PACKAGING
4. FABRICATION
5. ASSEMBLY
6. DIRECT LABOR
7. INDIRECT LABOR
8. METHODS SIMPLIFICATION (People)
9. METHODS SIMPLIFICATION (Machines)
10. QUALITY CONTROL
11. IN-PROCESS INVENTORY
12. MAINTENANCE
13. FLOOR SPACE
14. SPARE PARTS INVENTORY (Customer)
15. SPARE PARTS INVENTORY (V & O Machines)
16. CRITICAL OPERATIONS

V & O
AUTOMATIC
PRESSES
AND FEEDS

TOOLS of today



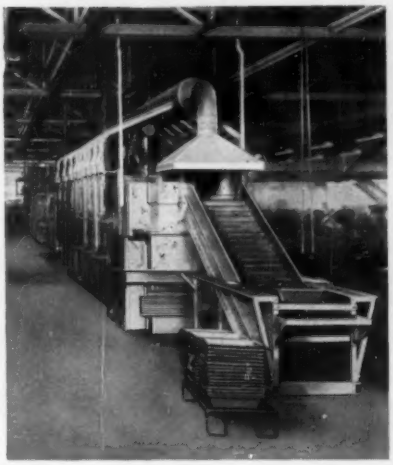
diameters ranging from 1/8 to 3/4 inch and body lengths from 5/16 to 5 inches. Wire capacity ranges from 0.072 to 0.010 inch. The looping tools and tool-adapter assemblies, which are easily removed and replaced for different runs without readjustment, are mounted much like those in four-slide assemblies.

Machine Div., Torrington Mfg. Co., Torrington, Conn. **Circle 424**

Packaged Inspection Unit Performs Various Jobs

Including six standard devices, this inspection unit meets virtually all requirements of machine shop and toolrooms. The V-Liner includes a surface plate, either 12 x 60 or 24 x 60 inches, available with two degrees of finish flatness, 0.0001 or 0.00025 inch. Among the accessory attachments are a concentricity checker and adjustable bench centers. The concentricity checking attachment—consisting of one V-block which adjusts vertically and another which adjusts horizontally—permits checking relative diameters and bores in shafts up to 50 inches long and 7¼

HOLCROFT



PRODUCTION HEAT TREATING EQUIPMENT

of any of these types

* BATCH
* CONVEYOR
* ROTARY
* CAR TYPE
* SHAKER HEARTH
* ROLLER TYPE
* WALKING BEAM
* PUSHER TYPE

HOLCROFT & COMPANY

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44 YEARS OF ENGINEERING LEADERSHIP

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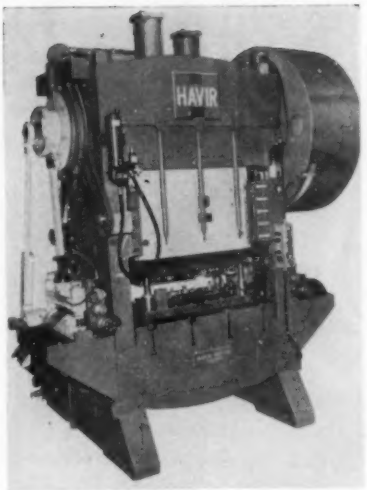
inches in diameter, with a diametral difference of up to 4½ inches. The adjustable bench centers accommodate shafts up to 48 inches long and 8 inches in diameter. A sine plate attachment, used in conjunction with the bench centers, checks tapers on shafts without the use of a surface plate and bench center combination.

Swanson-Erie Corp., 814 E. Eighth St., Erie, Pa. **Circle 425**

Machine Increases Press, Die Life

Increased press and die life are two features of the 150-ton Auto-Press. This high-speed automatic press has a cylindrical type ram for alignment of die and ram with maximum ram rigidity. The ram has maximum guiding surface to insure proper guiding of ram, punch and die. Use of tapered wedges behind the ram bearings allows take up. The press has operational speeds of 70 to 210 spm using an 18-inch-wide feed. Other features include automatic shut-



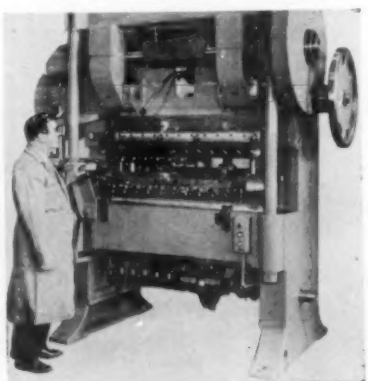
off, air-clamped feeds to prevent stock distortion and allow infinite controllable variations of roller pressure, built-in shock mounts and a spring-applied brake.

Havir Mfg. Co., 444 N. Cleveland Ave., St. Paul, Minn. **Circle 426**

USE READER SERVICE CARD ON PAGE 163 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

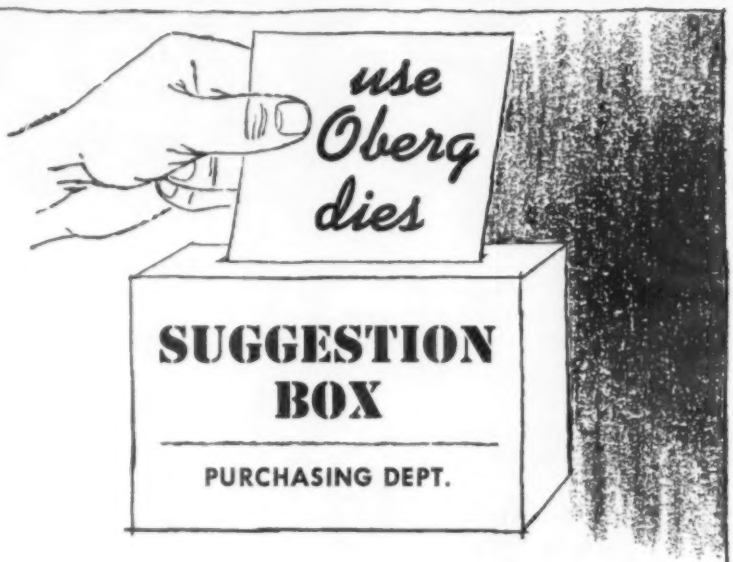
Transfer Press Produces Deep Drawn Parts

With a rated working pressure of 40 tons and a ram stroke of 7 inches, the Model 5L transfer press produces deep drawn parts such as pen caps, lipstick cases and electronic tube covers at rates up to 90 parts a minute. It has a depth of draw up to 3 inches and working die



space of 51 inches. It has 9, 10, 11, 12 or 14-station die sets. The maximum blank diameter of the nine-station die set is 3½ inches while the maximum blank diameter of the 14-station die set is 2¼ inches.

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn. **Circle 427**



Employees receive thousands of dollars annually from companies for money-saving ideas. But here's a switch! At Oberg, it is the customer who receives money-saving ideas—ideas that are designed, engineered and built into every Oberg Carbide Die by skilled personnel, equipped with experience and modern machines. These Oberg ideas pay off over the full life of the die! And you'll get some mighty fine ideas yourself when it comes to Oberg service. Because . . .

Oberg is something special

Oberg Manufacturing Co., INC.

FREEPORT, PA.

Send today for NEW brochure, Bulletin 261, describing Oberg dies, service and facilities.

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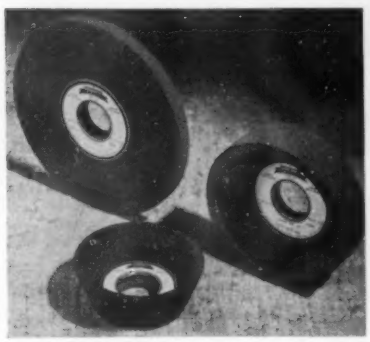
Grinding Wheels Use Man-Made Ruby Grit

Grains of man-made rubies and a glass type vitrified bond are combined in these abrasive wheels. The wheels are a purplish-red color because of the synthetic ruby crystalline aluminum

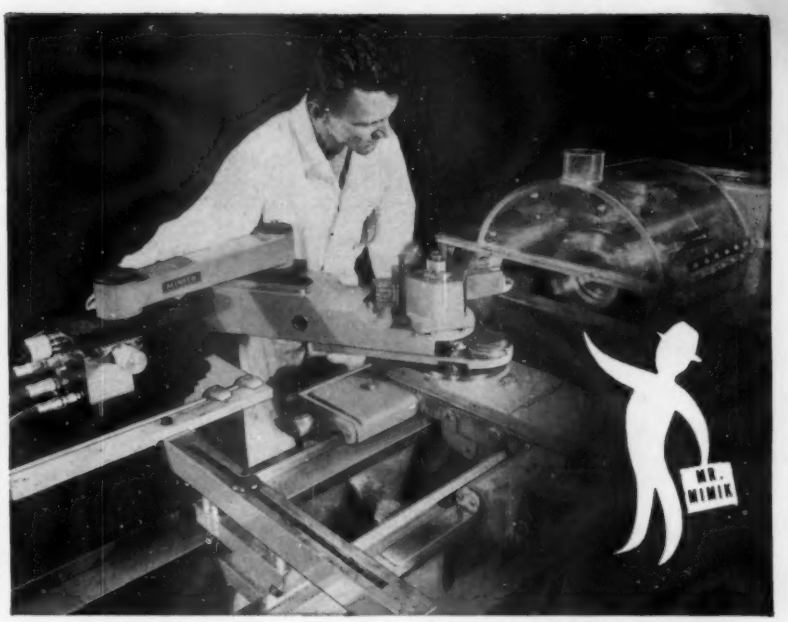


oxide. They have good friability and toughness, hold their shape well and give cooler, faster grinding than with conventional grains and bonds. The wheels can be used for surface grinding, internal grinding, and tool and cutter work, and are available in straight, cup, dish and flaring cup shapes, and in abrasive segments.

Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa. **Circle 428**

Tape Programmer Works Directly from Drawings

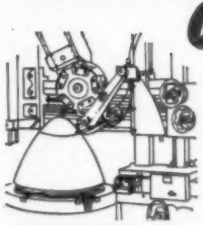
Time-consuming and expensive jobs such as dimensioning coordinate positions and preparing special templates or master boards are eliminated by this independent programmer which prepares 1-inch-wide, 8-channel tapes for drilling printed circuit boards directly from art. Used with any tape-controlled printed circuit driller, the machine enables the operator to locate up to 30 positions a minute. The machine corrects errors in the art work and makes it easy to find the desired grid positions. A positive hole indicating device and an automatic safety control insures ac-



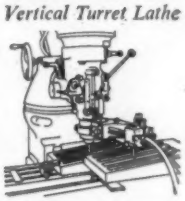
Machining beryllium with the MIMIK 9000 Tracer at The Beryllium Corporation's Hazelton, Pa., plant.

MIMIK®

GIVES THE ANSWER



Vertical Turret Lathe



Milling Machine

Engine and Turret Lathes

The question facing The Beryllium Corporation was how to speed production, cut high tooling costs and maintain close tolerance and finish in handling fast rising orders for hard-to-machine beryllium components. After a thorough study, aided by Mimik engineers, a decision was made to use Mimik Hydraulic Tracers on existing machine tools.

The Mimik Tracer, because of its extreme accuracy, versatility and complete interchangeability, gave The Beryllium Corporation added production capacity at a fraction of the capital cost required to install new machinery.

Changing production demands are met easily with the Mimik Tracer. The complete unit can be transferred in a matter of minutes from machine to machine regardless of make. The hydraulic slide action and super-sensitive 360° stylus control ensures that fine tolerances are consistently achieved.

Call or write for more information on the Mimik Tracers for engine and turret lathes, V.T.L.'s and milling machines. Request details of Mimik's unique guarantee of time and performance related to a specific job and machine.

MIMIK® TRACERS

MIMIK TRACERS INC., Buffalo, N.Y.

EAST: Mimik Tracers Inc., 3901 Union Rd., Buffalo, N.Y.
CENTRAL: Bartsch Tool Corp., 3714 Oakton St., Skokie, Ill.
WEST COAST: Allied Pacific Manufacturing Co., Compton, Cal.
CANADA: Retor Developments Ltd., Galt, Ontario

Mimik-men are everywhere

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curacy and reliability. The programmer covers an area of 24 x 24 inches and handles virtually all grid sizes with the use of interchangeable slides arranged for 0.1, 0.05 or 0.025-inch grids and art scales of 1:1, 2:1 and 4:1. Odd size grids such as 0.14-inch grids and grids that vary from the X to Y axes can also be handled.

Edlund Machinery Co., Cortland, N. Y. **Circle 429**

Optical Instrument Makes Internal Measurements

Among the measurement uses of the Linearscope are scanning; simultaneous scanning and measuring; probing hidden recesses; and checking external and internal squareness. Measuring capacity of the unit is 4 x 12 inches in one setting. Direct micrometer read-outs are 0.0005 and 0.0001 inch, with the tenth readings in the longitudinal direction. Travel is accurate to 0.0001 in 20 inches. The head can be turned through

360 deg and is calibrated 90 deg on each side of the center with a 5-min vernier. The eyepiece has either a 20X or 40X microscope with hairline reticle field of 0.488 or 0.240 inch, respectively. The image is erect and unreversed.

Westwood Engineering Co., 2234 Purdue Ave., Los Angeles 64, Calif. **Circle 430**

Torque Tester Calibrates Power Tools

Measuring torque release limits of nutrunners and screwdrivers with a repeatability of plus or minus three percent, this torque testing and setting gage assures uniformity of tightness in

USE READER SERVICE CARD ON PAGE 163 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

assembly. For hand or power tools, the tester provides a method of rechecking tools on the job. It is designed to meet the needs of accurate assembly in instrument, missile and aircraft plants.

The device is available in two torque ranges—zero to 30 in-lb and zero to 60 in-lb.

Scully-Jones and Co., 1946 Rockwell St., Chicago 8, Ill. **Circle 431**

SOSSNER *Introduces* Improved Tap Identification

Only **SOSSNER TAP PACKAGES GIVE YOU**

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- Tap Drill sizes easy to see
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- Label Color Coded for each GH limit

Write us for samples of SOSSNER labels and for information about the unique PERFORMANCE features of SOSSNER Taps.

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TAP & TOOL CORPORATION
27 Broadway, Lynbrook, L.I., N.Y.

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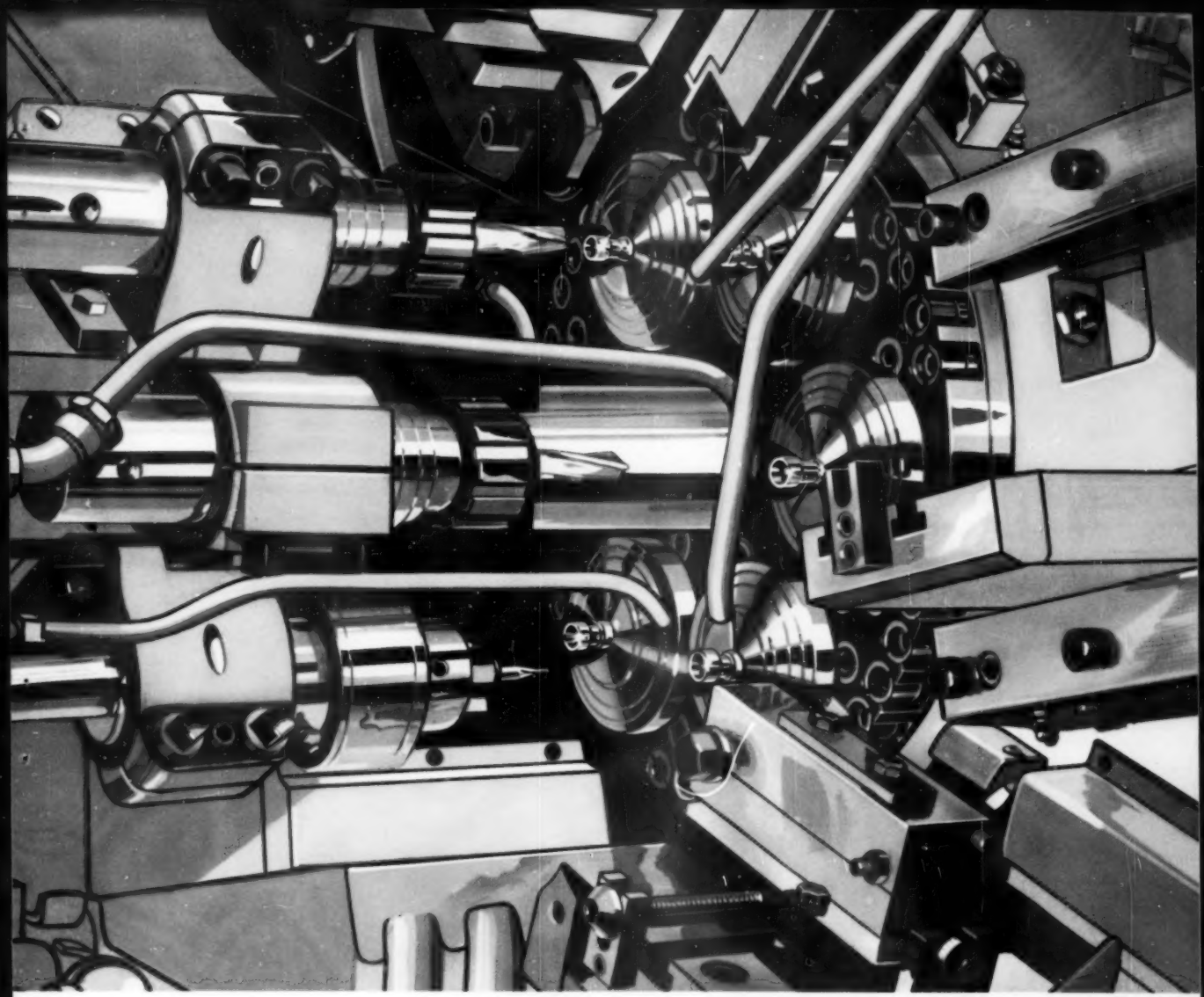
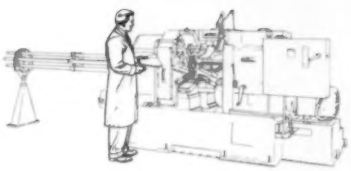


The newest bar machines *are New Britains*



How much work can you wring out of a bar machine? It depends on the machine, how it's tooled and who's using it. New Britain's New-Series Bar Machines are setting some pretty enviable productivity records right now. These machines, redesigned from the ground up, are the most advanced units of their kind available to the metalworking industry.

The four-spindle machines have capacity up to 5⅛" and all the massiveness and power needed to turn work of this size.

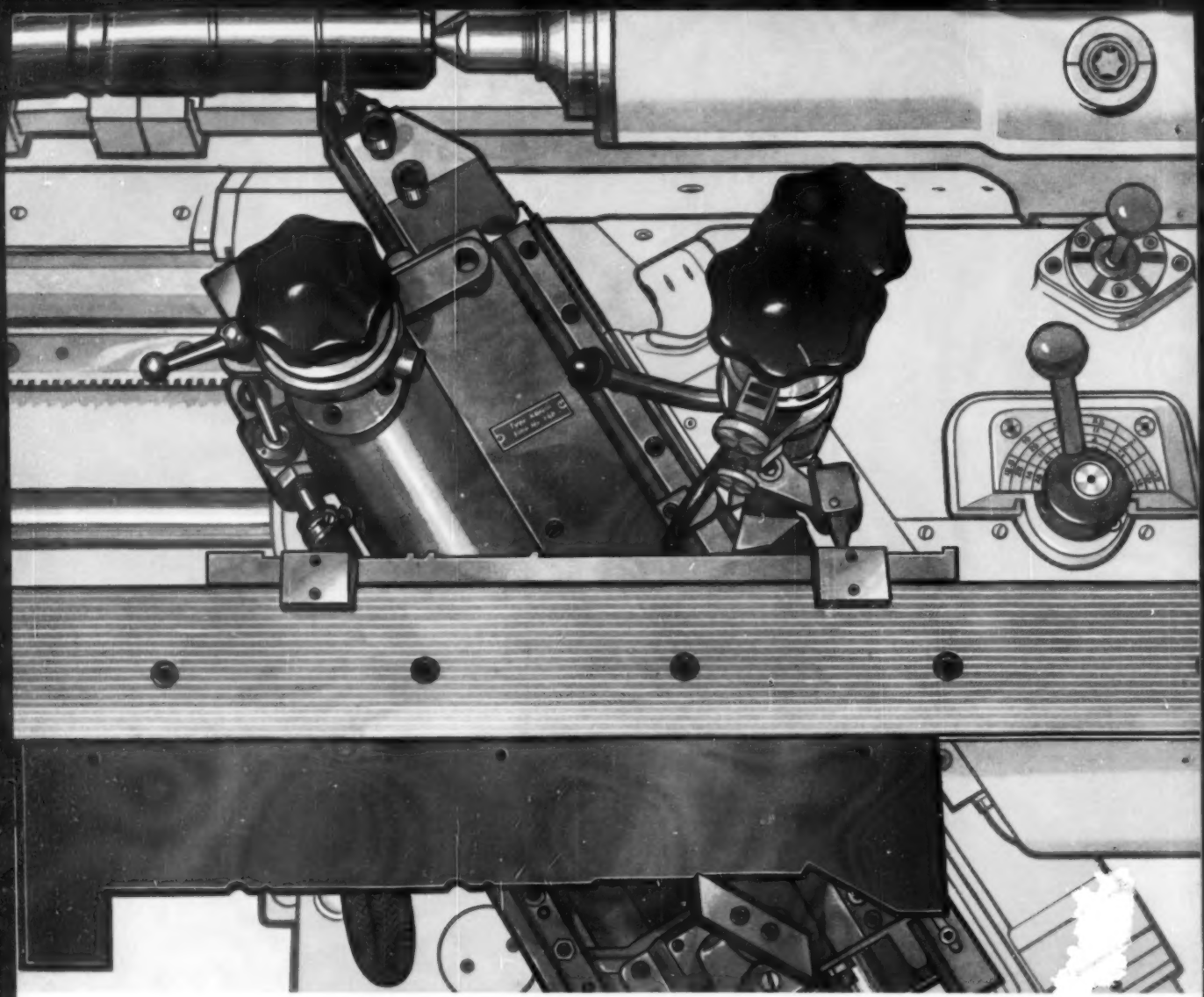
New series six-spindle machines in various models have capacities ranging up to 3½". The eight-spindle machines take work to 2⅝" capacity.

Increased capacity is only part of the story. Tooling combinations are practically limitless. With end-working and cross slide tooling in every position on every model, the greatest possible variety of operations can be performed to the highest order of accuracy. Numerous familiar New Britain features, like spindle carrier lifting and locating, have been retained and improved. A great many exclusive new features have been added.

Why not send for our new catalogs which give the whole story in detail or call your New Britain representative to arrange a demonstration?

THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division ◆ New Britain, Connecticut



Fast set-up, quick changeover *with New Britain* +GF+ *copying lathes*

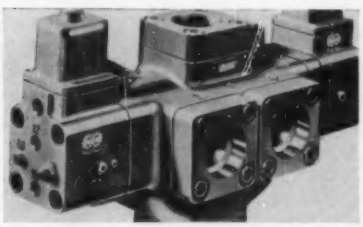
The basic design of a New Britain +GF+ copying lathe can start to save you money on the first job you put on it. Because the single tool is guided by either a prototype or a template, set-up time is reduced to minutes. The single tool can be changed in minutes, too. Every dimension is positively transmitted from template or prototype to the work, making adjustment a simple matter of bringing only one dimension to size. A +GF+ does a great variety of work—shafts, chucking work, internal *and* external copy turning. Backfacing is accomplished by a simple attachment. Multi-cut recycling for the removal of heavy stock concentration can also be provided.

The versatility of application is pretty much limited only by the ingenuity of the individual. For more complicated jobs, New Britain can provide the most complete selection of steadies, special tooling attachments and other accessories available for any lathe anywhere. A complete range of models and sizes is available. Why not write for our new +GF+ copying lathe catalog?

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division • New Britain, Connecticut

Fluid Power Valves Handle 3000 Psi

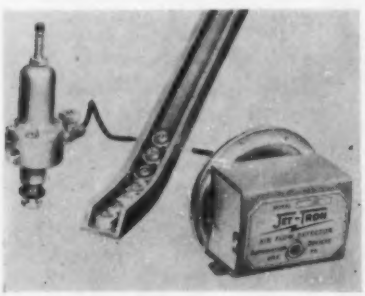
These solenoid-pilot operated valves for pressure up to 3000 psi are available in ½, ¾, 1, 1¼, 1½, 2, 2½ and 3-inch pipe sizes. The solenoid is totally enclosed and sealed against moisture and contaminated atmospheres. A stem in the solenoid cover permits manual pilot valve operation for set-up and trouble-shooting. The pilot valve incorporates a built-in check and adjustable choke allowing free flow in to shift the directional plunger away from the pilot valve and restricted flow out when plunger is shifted toward the pilot valve. Two-way valves are available with one pilot valve and spring returned end head and with one pilot valve and a hydraulic check-adjustable choke end head. Three and four-way valves are available with seven plungers for each size valve.



Oilgear Co., 1571E W. Pierce St., Milwaukee 4, Wis. **Circle 432**

Pneumatic Switch Detects Parts

Presence or nonpresence of any solid object, regardless of the material, can be detected by this pneumatic device. The Jet-Tron is a 7-amp, 120-volt, single-pole double-throw, snap-action control switch, operated by directing a 1.5-psi jet of air against the diaphragm of the switch. A jet of air is directed across a given space and any solid object interrupting this jet will cause the switch to operate. The unit is installed with an air line leading from a flow control valve to an open end. A receiver tube to the switch is installed opposite to the line leading from the control valve. A light pressure directed against the diaphragm will actuate the switch. An interruption in this pressure changes the position of the diaphragm thereby reversing the contacts. The switch is capable of several applications including feeder back pressure control, conveyor control, multiple-machine coordination, level control and solenoid operation.

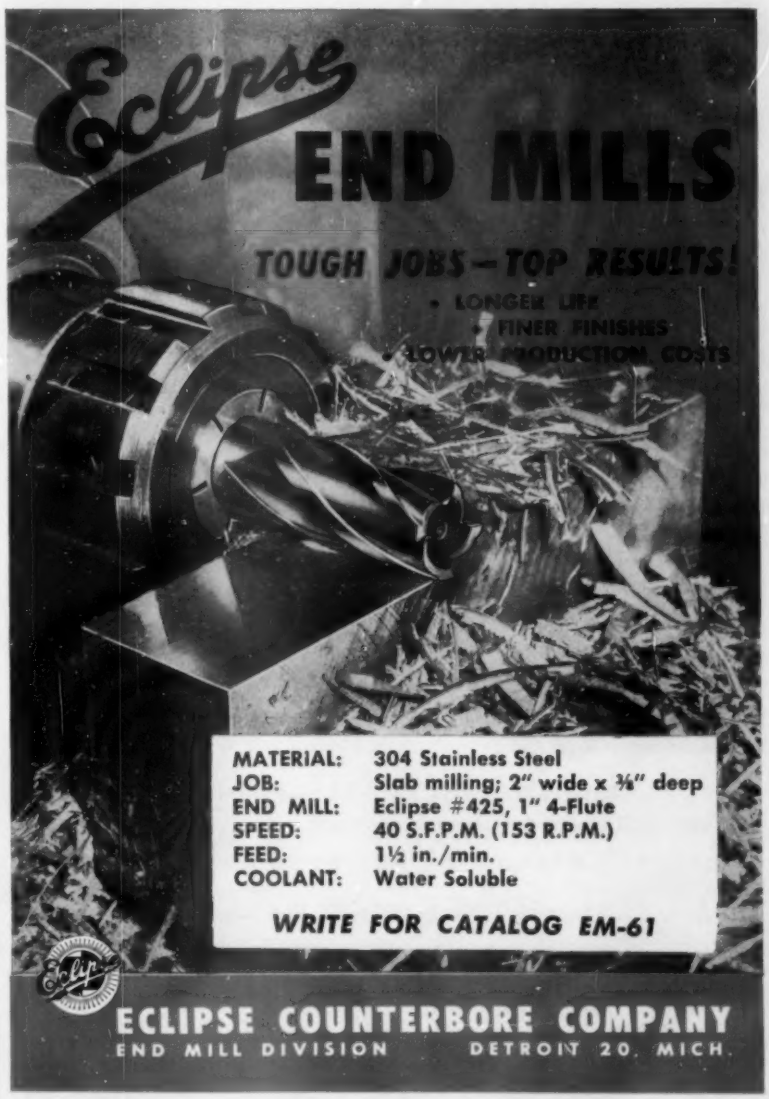


Automation Devices, Inc., 3125 Brandes St., Erie, Pa. **Circle 433**

USE READER SERVICE CARD ON PAGE 163 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electronic Package for Control Systems

This building-block electronic package is for use with servovalves and electrohydraulic servomechanisms in numerical and tracer control for machine tools. The package consists of a power supply, an operational amplifier, a carrier generator, a power demodulator and a chassis. Each of these components can be plugged in or out of the chassis as required. The system is used also for driving servovalves in printing



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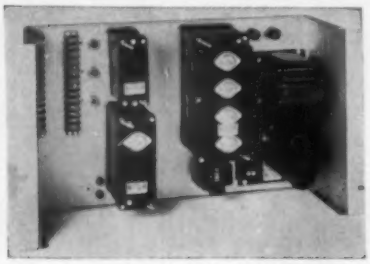


press control and color registration, in structural testing, in simulation systems such as those used for duplicating submarine motion and aircraft flight motion, in drives for radar units, in rocket launchers and ground handling equipment and in flying shear cutoff controls. The system is fully transistorized.

Moog Servocontrols, Inc., East Aurora, N. Y. **Circle 430**

USE READER SERVICE CARD ON PAGE 163 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

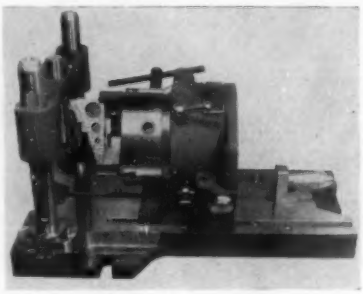
Threading Machine Handles Many Tools

Both ends of solid rod or tubing in lengths from 4 to 48 inches and from ¼ to ⅞ inch in diameter can be simultaneously machined, threaded or reamed by the Model 448 machine. It is a self-indexing machine with automatic infeed and outfeed. Its ends are completely independent of each other —each head has a three-speed feed motion and an individually driven quill type spindle. One head is fixed and the other is movable. The spindle speed and type of operation performed by each head can be varied.

Automation Design & Machinery Co., Inc., 1672 E. 233rd St., New York 66, N. Y. **Circle 431**

Drilling, Spacing Unit Handles Rotary Work

This horizontal drilling and master spacer unit for rotary positioning work has repetitive indexing with a radial accuracy of 0.001-inch cumulative error on a 6-inch-diam circle. Location of holes being machined in relation to the part can be held to ±0.0005 inch or closer. For toolroom or production



machining, the unit can be set up with a planer gage, micrometer or gage blocks. The master spacer has completely sealed tapered roller bearings, floating brake shoes which lock the spacer spindle without affecting spindle alignment, and a three-jaw, 6-inch chuck. An index wedge-plunger locates the 24-position plate.

Erickson Tool Co., 34350 Solon Rd., Solon, Ohio. **Circle 432**

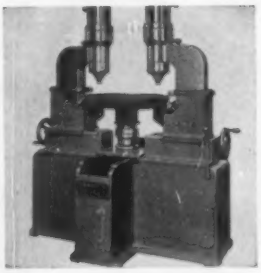
Honing Tool Has Longer Life

Taking the place of the stone holder and expansion pins in this honing tool is an expansion bar. Another feature is reversible wear plates, which effect a 100 percent increase in tool life. This design not only allows the original wear plates to be rotated 180 deg but also permits using the same heads for diameters larger than ½ inch by plac-

"Hy-Power" by HANNIFIN
5,000 PSI HYDRAULICS

Proved by more than 25 years use in the Automotive Industry

BETTER THAN EVER TODAY



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PRODUCTION TOOLS

Used on trucks, trailers, automobiles and throughout industry

Used for riveting, punching, pressing, marking and press-fit assembly

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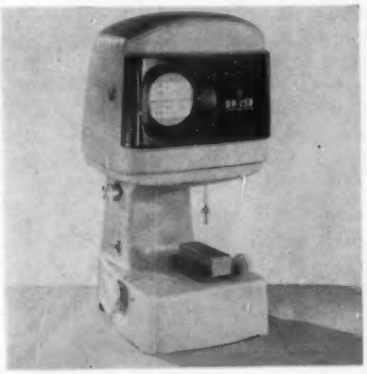
Use Reader Service Card, CIRCLE 106

ing larger wear plates and expansion bars in the same head. The wear plates can be rotated and changed without taking the tool out of the machine.

Allied Machine and Engrg. Co., Div. of Mid-West Abrasive Co., Owosso, Mich. **Circle 433**

Optical Device Eliminates Gage Blocks, Master Setups

Accurate to 0.000025 inch, the DR-25B optical gage operates within a temperature range of 50 to 90 F without correction tables. Because it measures parts directly, it eliminates gage blocks

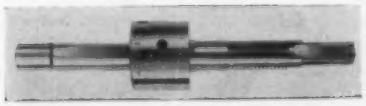


or master setups. Suited for gaging of parts on which a number of dimensions must be checked, the instrument can be used in production or in a laboratory or toolroom. Its measuring capacity is from zero to 3 inches. Each instrument is supplied with an anvil adapter which will accept any standard anvil or special fixture.

Bausch & Lomb Inc., Rochester 2, N. Y. **Circle 434**

Threaded Mandrels Hold Workpiece in Position

Threaded expanding mandrels, designed to hold work on the pitch diameter of internal threads are available in unified coarse thread series from ¼"-20 to 2½"-4 and in unified fine thread series from ¼"-28 to 1½"-12. Accurate



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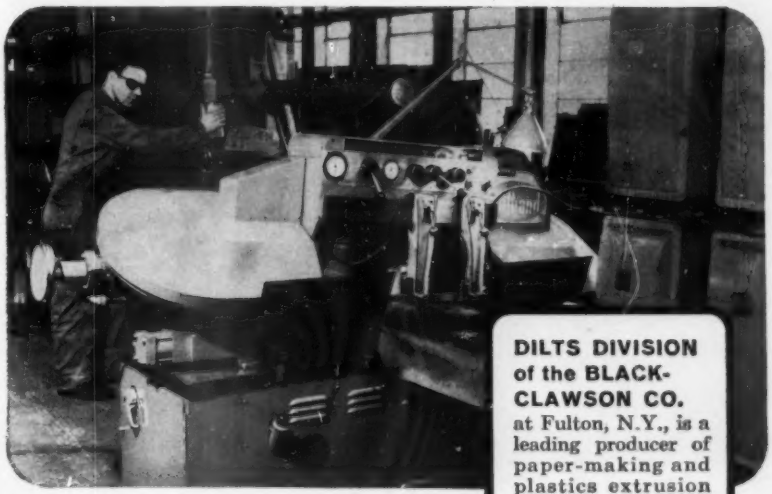
to 0.0002 inch TIR, these mandrels can be used for machining, grinding, balancing and inspection, where the workpiece must be held on the pitch diameter of an internal thread and the outside diameter must be held concentric, or where the shoulder of the workpiece must be held square to the internal thread.

LeCount Tool Works, Inc., P. O. Box 252, Cheshire, Conn. **Circle 435**

Electronic Level Works at 300-Ft Distance

In the Talyvel electronic level, the bubble is replaced by a pendulum and a pair of variable inductance transducers which provide a signal amplified to a center-zero meter. Both the transistorized amplifier and meter are scaled in angular as well as linear measure. Battery-operated, the instrument can be mounted in places where it is difficult to read a block level. The meter unit can be placed at a distance up to 300 ft from the level unit. The instrument



DILTS DIVISION of the BLACK-CLAWSON CO. at Fulton, N.Y., is a leading producer of paper-making and plastics extrusion machinery for a world-wide market.

MILBAND®

Band Saw Machine Tool

"Considerable savings in cutting time . . . spoilage is negligible . . . maintenance is no problem," says Shop Superintendent Howard Knight after a year of experience with the MILBAND Machine Tool. Metal-cutting work at DILTS DIVISION of BLACK-CLAWSON CO. involves a variety of carbon and stainless steels for the intricate custom-made machinery designed and fabricated by the company.

Dilts Division is one of many users who have found that MILBAND's rugged construction eliminates destructive vibrations. The results are a high degree of accuracy and noticeably long blade life . . . especially when the *MILFORD REZISTOR High Speed Steel Blade* is used in combination with the MILBAND Machine. Superior Blade Control Engineering at every critical point in the MILBAND . . . including 30° blade twist, large 22" blade wheels and 15½" pivot span . . . assures maximum blade life and precision cutting on the toughest jobs.

Demonstrations are easily arranged. Write us for the name of the MILBAND dealer nearest you . . . and for this free circular explaining all the cost-cutting facts about the MILBAND Machine Tool.

THE HENRY G. THOMPSON & SON CO.
Chapel & Dill Sts., New Haven 5, Connecticut
Saw Specialists for 85 Years

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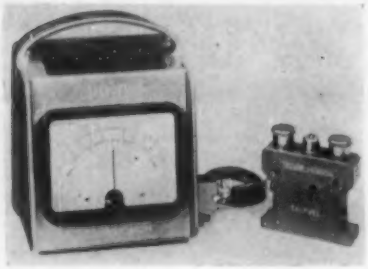
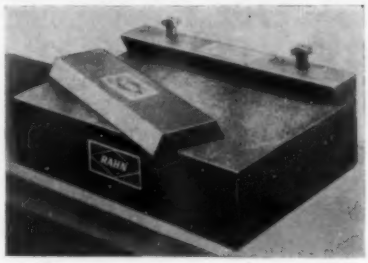


is particularly valuable for machine tool testing, releveling and adjustment; for use on missile and rocket launchers; and for determining sway of large structures.

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **Circle 436**

Plate for Spotting, Scraping 60-deg Angles

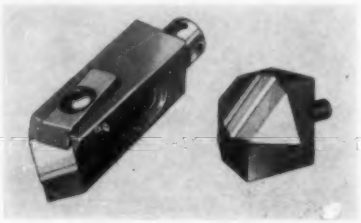


These black granite plates are used in spotting and scraping the 60-deg angle on machine gibs and slides. The machine slides are spotted on the surface plate with an attached 60-deg strip and the gibs are spotted to the small plate, which has two 60-deg slides. The tolerance for straightness and flatness on flat surfaces is ±0.000025 inch and on 60-deg angles plus 0°0′0″ and minus −0°0′30″.

Rahn Granite Surface Plate Co., 635 N. Western Ave., Dayton 7, Ohio. **Circle 437**

Adjustable Units Hold Close Tolerances

Special tools for boring, chamfering and facing operations can be made with the building block approach with these adjustable units. They use Kendex throwaway inserts. Two-way adjustments of the bore diameter and shoulder length aid in maintaining close tolerances on critical dimension work by microadjustment of a screw when compensation for insert wear is required. The units are available with rake and lead angles that meet a wide range of job requirements.



Kennametal, Inc., Latrobe, Pa. **Circle 438**

Boring Machine Has Advanced Design Features

This 37-ton horizontal boring machine—the 5H-144 Spiramatic Jigmil—has a 24-ft, 33,000-lb, cast iron bed. The bed is flat to within tenths and has an accuracy of 0.0001 inch for straightness and alignment on all working surfaces. The machine has a 5-inch spindle. Ver-

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Moore Jig Borer area at Fibreform Electronics; checking fixtures and inspection tools in the foreground.

"We feel strongly that our seven Moore Jig Borers are the heart of our business today." —says *Fred H. Sperbeck, partner, Fibreform Electronics, Inc., Los Angeles*

"The trend towards closer tolerances, small quantities, and quick deliveries on precision-machined parts for the electronics and missile industries has created a most difficult problem for companies manufacturing these parts.

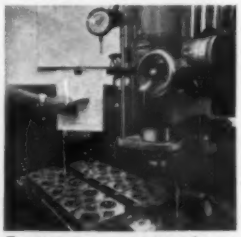
"Our answer to this problem is the Moore Jig Borer. Through careful planning and precision gaging, we have given our jig boring area the same production capabilities as our other departments. This not only eliminates the time and cost of many precise jigs and fixtures, but also, in many cases, reduces labor costs of highly skilled operators.

"At Fibreform Electronics, we feel strongly that the seven Moore Jig Borers we have purchased since 1956 are the heart of our business today, and will continue to be in the future."

For locating and boring holes in dies, jigs and production parts, the speed and accuracy of the Moore Jig Borer has never been equalled. You can easily split "tenths" with the new Moore No. 3 Jig Borer.

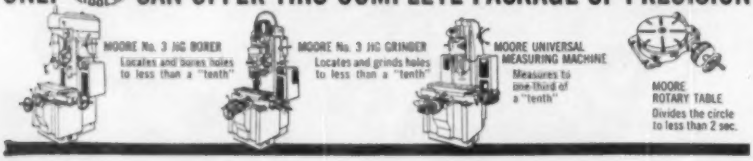
Prove it to yourself by writing for illustrated brochure. Also, on request, we will send you data on the Moore No. 3 Jig Grinder, which locates and grinds holes to less than a "tenth."

Moore Special Tool Company, Inc.
732 Union Avenue, Bridgeport 7, Connecticut



Ten pieces on one set-up means that cutting tools are loaded only 10% as often. This also cuts inspection needs to 10% of the holes. Parts are spaced on even inch increments to simplify charting.

ONLY MOORE TOOLS CAN OFFER THIS COMPLETE PACKAGE OF PRECISION


MOORE No. 3 JIG BORER
Locates and bores holes to less than a "tenth"
MOORE No. 3 JIG GRINDER
Locates and grinds holes to less than a "tenth"
MOORE UNIVERSAL MEASURING MACHINE
Measures to one-third of a "tenth"
MOORE ROTARY TABLE
Divides the circle to less than 2 sec.

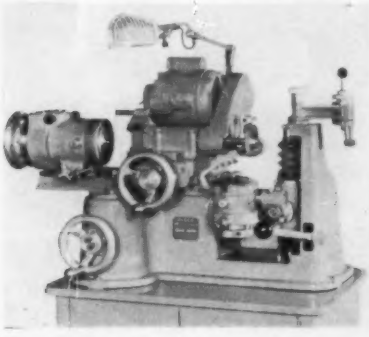
Use Reader Service Card, CIRCLE 108

tical movement of the spindle head in the machine column is 6 ft. Its 50-inch-wide table provides a 12-ft horizontal travel. Direct power to the spindle of the machine is provided by a 20-hp motor. Range of the spindle bar travel is 24 inches. Tool changes can be made with the spindle bar in any position within its range of travel by a power lock mechanism. Range of the machine's table retraction is 24 inches. The machine is also designed for advanced control systems.

DeVlieg Machine Co., Royal Oak, Mich. **Circle 439**

Grinder Sharpens Chamfers, Straight and Spiral Taps

Illustrated is the Model 1100 tap grinder which sharpens chamfers, straight flutes and spiral points from a No. 6 machine screw tap up to and including 2⅝ hand taps. All taps are held



on their shanks so that they can be resharpened even after the center has been destroyed. The chamfer and flute heads have quick-change cam pin plates, making it possible to sharpen taps with any number of flutes.

Henry P. Boggis Co., 706 E. 163rd St., Cleveland 10, Ohio. **Circle 440**

Plasma Gun Duplicates Coatings

Three components—a console with automatic controls; a powder feeder; and a spray gun with one-piece nozzle and all-purpose electrode—make this plasma spray coating system. The system, designed for duplication of coatings, permits flame spray speeds with most materials of 5 to 15 lb an hour with a deposit efficiency of 65 to 80 percent. Tungsten carbide, for example, has a deposit efficiency of 75 percent. The gun has six interchangeable parts and handle. Its light weight of 3¼ lb permits hand operation, but it can be machine mounted. It is small enough for spraying internal bores down to 5 inches ID. The gun has no moving parts and requires no adjustments.

Metco Inc., 1101 Prospect Ave., Westbury, L. I., N. Y. **Circle 441**

Multiple-Process Welder Handles Many Jobs

Designed for fabricators who use more than one of the new semiautomatic processes, the Multi-Wire machine is a combination welder and matched wire feeder. A family of welding guns has been developed for each process. When changing from one process to another,

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Regal

SOLID CARBIDE TAPS

✓ CHECK LIST

- ☐ Aluminum
- ☐ Ceramics
- ☐ Beryllium Copper
- ☐ Beryllium
- ☐ Powdered Metals
- ☐ Fibre
- ☐ Plastics
- ☐ Bronze
- ☐ Magnesium
- ☐ Cast Iron
- ☐ Zamack
- ☐ Fibre Glass
- ☐ Hard Rubber
- ☐ Lead
- ☐ Teflon
- ☐ Astralloy
- ☐ Waspalloy
- ☐ Bakelite

INCREASE TAP LIFE 100 TIMES OR MORE!

Solid Tungsten Carbide taps have become a necessity for many modern day industries. Recommended for highly abrasive materials where production records have shown solid carbide taps to produce as much as 300 to 400 times high speed steel. Available in stock in machine screw, fractional, and pipe taps. Many specials in stock.

NEW TECHNICAL DATA AND PRICING CATALOG

Material recommendations, speeds, lubricants, and complete quantity pricing. Circle order card or write:

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ATTN. DISTRIBUTORS AND REPRESENTATIVES: WRITE FOR AVAILABILITY OF TERRITORY.

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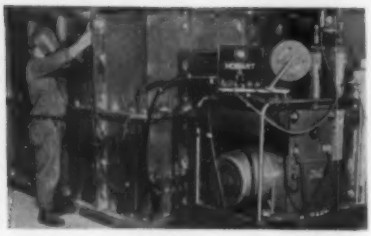


the operator attaches the appropriate gun and cable assembly and installs the appropriate drive rolls and wire guides. The processes that can be used are the small-wire, all-position gas-shielded welding process; the large-wire CO_2 welding process; the combination tubular or fluxed wire and CO_2 gas-shielded process; the inert-gas-shielded metal-arc process for nonferrous metals; the hardsurfacing process; and the submerged arc process. At a 60 percent duty cycle the machine will produce 650 amp.

Hobart Co., Troy, Ohio. **Circle 442**

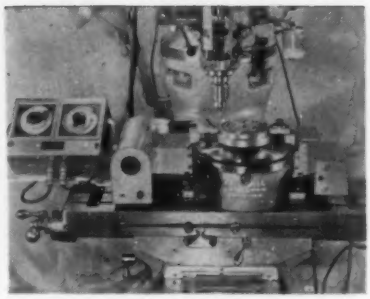
Photoelectric Units Add to Operator Safety

Because the machine stops whenever an operator's hand or arm interrupts its modulated light beam, the Modulite protective unit increases operator safety. A disk, rotating at 540 cps, modulates the light. A projector, receiver and control relay setup is tuned to the modulated light frequency to signal and stop the machine. The projector—unaffected by ambient light—has either a 1 or 2-inch light beam with ranges of 20 and 80 ft., respectively.

Clark Controller Co., 1146 E. 152nd St., Cleveland 10, Ohio. **Circle 443**

Indexing Tables Are Electronically Operated

Designed for automatic spacing of hole patterns in degree, one-half degree or one-tenth degree increments, the M-M 800 Roto Mill electronic index table can also be used for programming a part that requires slot milling.

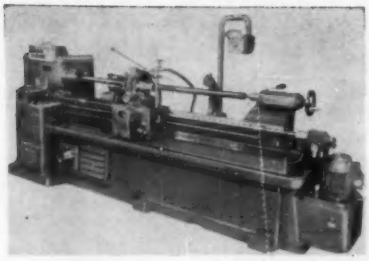


By use of a 15-inch program plate, it can program uneven indexes. It can be used in a vertical or horizontal position for drilling, boring, jig boring, checking, milling and spacing. It is powered with a 110-volt, 60-cycle motor and has a slip clutch for hand operation.

M & M Tool & Mfg. Co., 1124 E. Third St., Dayton, Ohio. **Circle 444**

Vibratory Finisher Rolls Through Full Radius

This vibratory finishing machine will clean, descale, deburr, radius, finish,



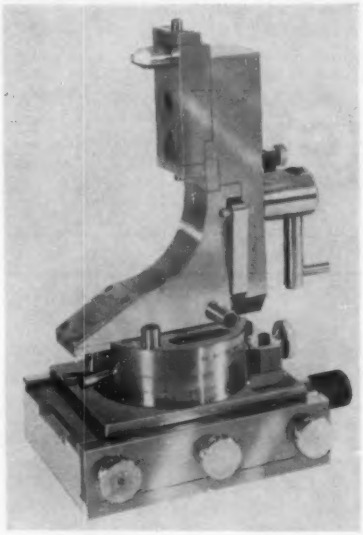
burnish, color and abrade castings, forgings and other products. It has a full radius roll-over tub and compact cut-back housing design. Its 180-deg tile facilitates unloading. Another feature of the Vibrado is its controlled orbital flow pattern with synchronous vibration. The unit is available in capacities from 1/10 to 20 cu. ft.

Jackson Vibrators, Inc., Ludington, Mich. **Circle 445**

USE READER SERVICE CARD ON PAGE 163 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Wheel Dresser for Inside and Outside Grinding

This wheel dresser with adjustable diamond height has two holders for the diamonds. Its primary use is for grinders where the dresser needs to be mounted on a solid angle ramp and both the external and internal grinding wheels are to be dressed. It has a 12-inch-diam wheel capacity. Model RFG 650A also has a removable micrometer base for controlled infeed of the diamond on surface grinders.



J & S Tool Co., Inc., 87 Dorea Ave., Livingston, N. J. **Circle 446**

End Mills Cut All Materials

All end mills in a line of miniature high-speed end mills have two or four flutes and 3/16-inch shanks. Two of the eight available styles are stub length, two flute, single-end and long length, two flute, double-end styles. Used for plunge cutting, slotting, contour cutting, profiling and general purpose end milling on virtually all materials, Thriftmite end mills are especially suited for slotting or router type cutting of fiber sheets, laminates and other thin synthetics or alloys. They are ground with 40-deg helical flute.

Brown & Sharpe Mfg. Co., Providence 1, R. I. **Circle 447**

BUTTERFIELD
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Whatever your end mill applications may be — ranging from simple to multiple machining — you'll find Butterfield end mills outstanding for quality, precision and long life. These advantages are engineered into the complete Butterfield line. For fast deliveries of any Butterfield tools, and expert technical aid in your machining . . . Call your Butterfield Distributor today. Warehouses in Chicago, Detroit, Fort Worth, Los Angeles, New York and San Francisco.

BUTTERFIELD
BUTTERFIELD

Division, Union Twist Drill Company, Derby Line, Vt.

Use Reader Service Card, CIRCLE 111

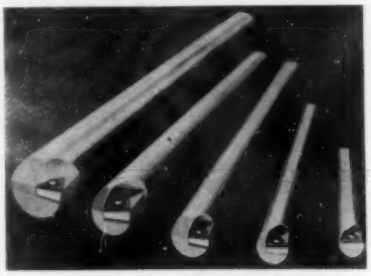
Optical Gage Checks Dents and Scratches

Scratches, grooves and other indentations on flat or curved surfaces can be measured to determine whether such surface indentations fall within prescribed limitations by this scratch depth gage. The unit was designed primarily for the inspection of wing skins of aircraft and high pressure pipe and tubing, where scratches exceeding specific limits could result in structural failure. Measurements to an accuracy of ±0.0001 inch or 5 percent of the depth, whichever is greater, can be made for indentations with depths of from 0.0002 inch to 0.016 inch. Widths from 0.001 to 0.050 inch can be determined to ±0.001 inch. In addition to depth and width measurements, the gage clearly shows the contour of the indentation.

Bausch & Lomb Inc., Rochester 2, N. Y. **Circle 448**

Boring Bars Eliminate Chatter, Reduce Vibration

Chatter, vibration and deflection are minimized with the Kendex BB-7000 K-Bars. The shanks of these bars are of a material that is three times more rigid than steel. Five sizes of the bars



have diameters of 3/8, 1/2, 5/8, 3/4 and 1 inch and respective lengths of 6, 8, 10 and 12 inches. Triangular inserts and chipbreakers are used with the bars.

Kennametal Inc. **Circle 449**

Feed Units for Drilling, Tapping

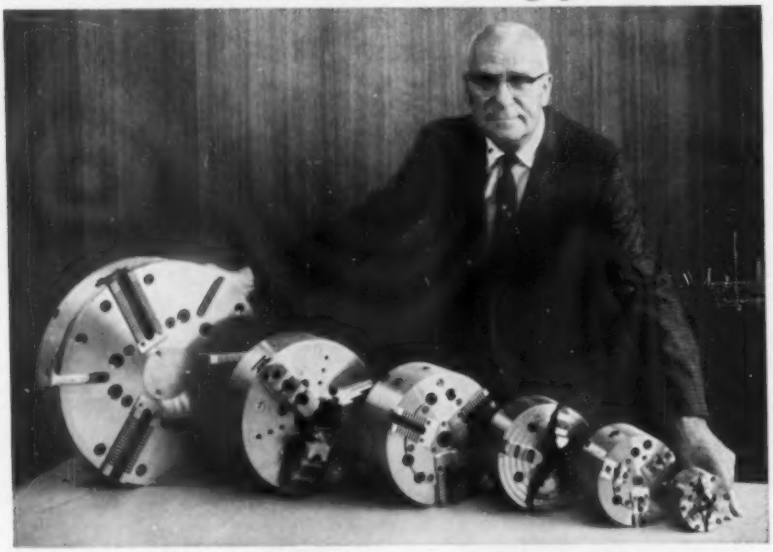
Drilling, tapping, reaming, facing and counterboring are among the jobs performed by quill type Holomatic power feed units, either as single units or in groups on special machines. Powered for stroke either by air or hydraulic sources, these units are available in three power and feed styles—air hydraulic, balanced air and hydraulic. Electric motors of up to 1 hp mounted on belt housings are coupled through V-belts and pulleys to develop rotational power on the spindles at speeds from 400 to 20,000 rpm. Stroke length is infinitely adjustable to 2 inches.

USE READER SERVICE CARD ON PAGE 163 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Air-powered units can drill up to 3/8-inch-diam holes in mild steel while hydraulic-powered units can drill up to 1/2-inch-diam holes in similar material. Either style unit can be used to tap holes up to 7/16-14 in steel by motor reversing action or with reversing type tapping attachments. Feed rates are controlled by a load compensating valve which automatically corrects for variations in input power, load and friction. The spindle, quill, force pistons and positive stop all work on a common centerline. Depth accuracies of 0.0005 inch can be maintained with the positive stop and dwell.

Hause Machine, Inc., Montpelier, Ohio. **Circle 450**

Here they are—the *Buck* chucks that solve most work-holding problems



Left to right:
6 of the 15 types of Buck chucks.

1. Aluminum power chuck with gibbed keyways
2. Dust proof chuck
3. Steel Power chuck, Serrated Jaws
4. Independent chuck
5. Steel Power chuck, American Standard
6. 6 jaw Ajust-Tru

Ready to cut your machining costs

You start saving—on production or in the tool room—the day you put Buck Ajust-Tru chucks to work.

MANUAL chucks adjust for dead true precision in a minute — *guarantee .0005" precision chucking duplicate parts.*

POWER chucks—steel or aluminum body, regular or serrated jaws—*guarantee precision within .001"* and provide many other exclusive operating savings.

It's the unique, patented Buck Ajust-Tru principle that makes Buck chucks so different—*at no price premium.* It'll be well worth it to get full details.

NEW Catalog 61 ready—write for it.

BUCK TOOL COMPANY

933 SCHIPPERS LANE • KALAMAZOO, MICH.

Use Reader Service Card, CIRCLE 112

Double-End Cutoff Tool Is Ready-to-Use

Both ends of the Manchester high-speed-steel cutting insert are ready to use. Back taper and front and side clearance are preground at both ends. The center section of the insert is relieved to insure clearance regardless of depth of cut. Inserts of T-15 high-speed steel are available with widths of ⅛, 3/16 and ¼ inches and depths of ⅝ to 2 inches.

Portage Double Quick, Inc., 1054 Sweitzer, Akron, Ohio. **Circle 451**

Combination Mill for Horizontal, Vertical Work

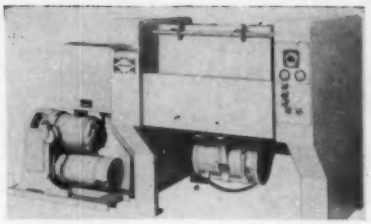
This combination horizontal and vertical mill has a table travel of 12½ inches. Table size is 6 x 18 inches. Two interchangeable spindle assemblies accommodate both vertical and horizontal milling operations on the same machine. Manual screw feed on all table motions is available or production models can be supplied with rack and pinion feed on both vertical and longitudinal motions or longitudinal table alone. Accessories include an independent table power feed unit, arbors, overarm support brackets, rotary tables, vises, a full line of collets and a floor stand.

Benchmaster Manufacturing Co., 1835 W. Rosecrans Ave., Gardena, Calif. **Circle 452**

USE READER SERVICE CARD ON PAGE 163 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Threading Lathe Has 80-Inch Stroke

This machine is capable of automatically threading internally and externally by a series of passes in which the spindle speeds, feeds and number of passes are preselected. When the cycle is complete, the machine stops automatically. The machine—Model 3L—offers an 80-inch stroke and measures



84 inches between centers. Spindle bores of up to 16 inches and swings of up to 24 inches are available.

Man-Au-Cycle Corp. of America, Brooklyn 32, N. Y. **Circle 453**

Magnetic Chuck Holds Thin Parts

For a workpiece 0.008-inch thick, the Micro-Mesh permanent magnet chuck has a holding power of 2½ psi. Because holding power over the entire magnetic surface is uniform, the chuck can be used fully loaded for maximum production. The usual weak zone in the handle area has been eliminated by locating the handle shaft support mechanism on the chuck exterior. The chuck has a close-space pole arrange-

For { 8-STATION PRODUCTION MACHINING
1½" BAR AND COLLET WORK
CHUCKING
SINGLE POINT THREADING

Costs { $7,167.00 FOB Factory Complete with all standard equipment

This is an all new 1½" bar capacity ram type turret lathe with power feeds to all 8 working stations . . . that in addition to bar and collet work also has the versatility to do chucking, and when needed, single point threading. Powered by a 5 h.p., two-speed, geared motor, the new Sheldon 3 R turret lathe provides 16 spindle speeds, 60 different feeds to the carriage and cross-slide, and 180 different feeds to the ram turret.
The turret itself is ruggedly built and accurately machined to provide close tolerance indexing. And for complete ease of operation, it is put under power by simply pressing a push button on the control panel.

This new 3 R Sheldon is completely equipped with two-speed motor and electrical controls, coolant system and splash guards, LO spindle nose, large satin chrome dials and hardened bed ways. It also provides an additional cost saving feature—each turret face is drilled and tapped for your standard flange type tooling as well as being bored for your standard 1½" shank type tooling.
For versatile, accurate machining in either long or short runs, the new Sheldon 3 R provides the answer to low investment cost with high profit operation.

New SHELDON 3R TURRET LATHE

Write for bulletin with complete specifications and tooling data

SHELDON MACHINE CO., INC.
4229 N. Knox Ave. • Chicago 41, ILL.
Builders of 10", 11", 13", 15" Sheldon lathes, Sheldon Milling Machines, Sheldon Shapers and Sebastian Geared Head Lathes

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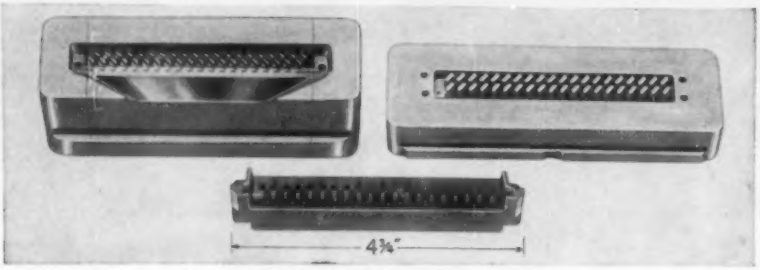
UHB Orvar Tool Steel
Provides High Dimensional Stability



Transfer Mold made by H. Feier Tool and Machine Co., Merchantville, N. J.

With a plastic part this complex, retaining dimensional stability of the transfer mold is important! Elco Corporation, Philadelphia, found UHB Orvar "Superior, even on long sections . . . ". This transfer mold will produce approximately 3 million Diallyl Phthalate plastic electronic connectors, at 25 shots per hour – 3000 psi. The mold cavity was easily machined. Heat treatment brought hardness to Rockwell C 53-55, without deforming or scaling.

UHB Orvar (SAE H-13) is a hot-work tool steel having excellent heat-checking, non-deforming and non-scaling properties – even under rapid heating and cooling cycles.

Write for information on UHB Orvar Tool Steel, Today!

UHB TOOL & DIE STEELS COLD ROLLED SPRING STEELS

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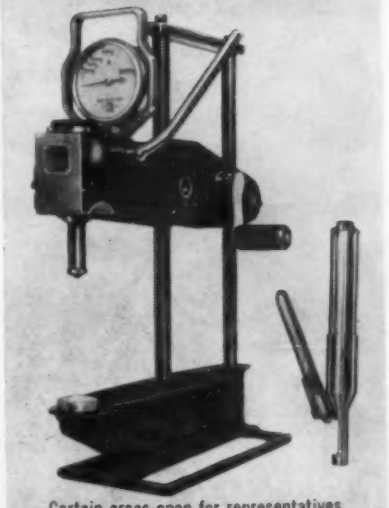
DELIVERS ALL THREE FOR UNLIMITED USES!

Precise quality control — the most important function of any hardness test, is one of the many reasons users depend on the King Portable! Together with the King Brinell Scope, the King Portable provides quick readings on almost any size or shape of metal in practically any location!

Economical too, because one test head can be used in many inexpensive adapters.

Get complete information now by writing for literature, prices and a demonstration.



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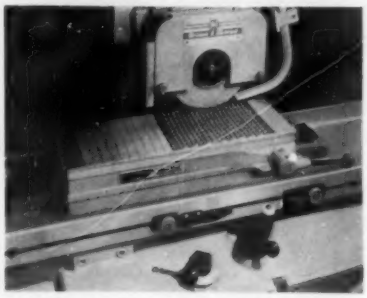
TOOLS of today



ment with barium ferrite magnets, which permits machining work as small as 0.001 inch. It has a 6 x 18-inch working surface; a 6 x 15¾-inch magnetic surface; and a 6 x 18-inch base.

Brown & Sharpe Mfg. Co., Providence 1, R. I. **Circle 454**

Unit Monitors, Displays Tapping Torque

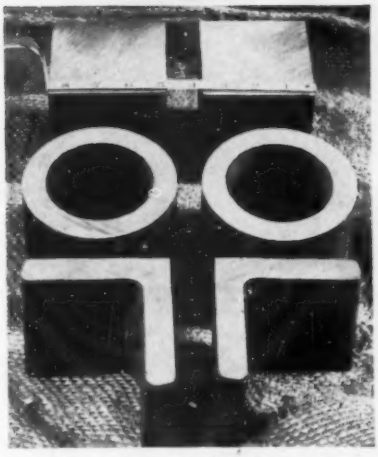
Model T-300 Hydra Tapper controls and monitors torque delivered to the tap. When the tap begins to load up to the preset torque level, the spindle reverses to clear chips and then reverses again to continue the tapping cycle. This feature is especially advantageous when tapping materials such as titanium and stainless steel. The machine is leadscrew-driven but can tap

all pitches with the same leadscrew. The unit will drive a 1½-inch tap and develop 400 in-lb stall torque at 1500 psi. It has thirteen spindle speeds between 90 and 611 rpm and spindle travel of 4 inches. Depth is controllable to within less than ¼ of one revolution.

Milman Engineering Co., Inc., 11162 Santa Monica Blvd., Los Angeles 25, Calif. **Circle 455**

USE READER SERVICE CARD ON PAGE 163 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

These 6 finely finished surfaces required only 3! operations or just 1/2 operation per end



How do you do jobs like this in your shop now?

And in the process the metal was also severed or CUT AT THE SAME TIME.

24 seconds to cut the 2 squares
20 seconds to cut the 2 tubes
12 seconds to cut the 2 angles

OR less than one minute for the whole job — Cut 3 pieces! And also finish 6 ends at the same time.

Can you afford not to investigate?

Write or phone COLLECT to Klaus von Frantzius. Ask for information about "Cut-Machining."

WALLACE
SUPPLIES MFG. COMPANY
3504 N. Ravenswood Ave. • Chicago 13, Illinois
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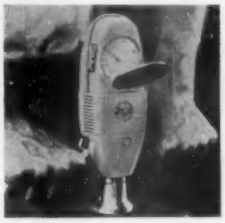
Hardness Tester Checks Complicated Contours

This instrument can be used as a bench type unit for inspecting small parts. Removed from the stand or frame, the main body can be equipped with hand grips and used to check the hardness of large objects. The instrument can be used to check steel

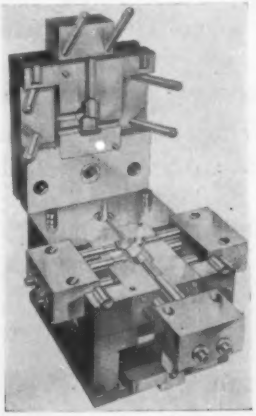


and soft metals such as aluminum or copper whose thickness is more than 0.6 mm. Standard accessories include a flat anvil, a V-anvil, inclined bed and gage, and an indenter testing tool. Readings are in both Vickers and Rockwell units.

Radio Corporation of America, Industrial and Automation Div., 12605 Arnold, Detroit, Mich. **Circle 456**

Unit Die For Automatic Die Casting

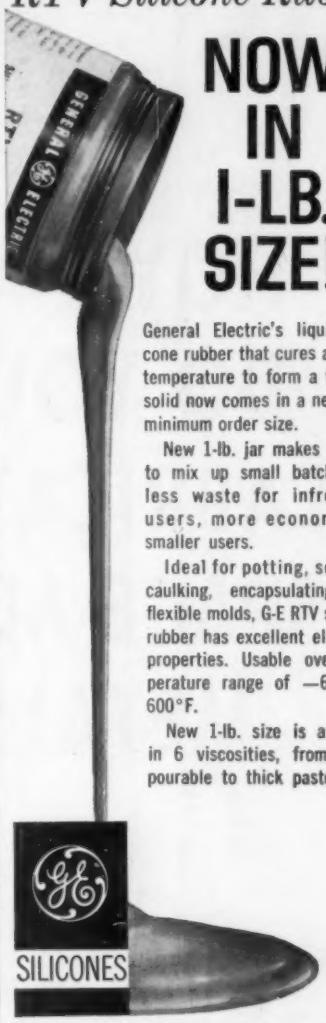
This single-station Master-Mold unit die, incorporating side core pulls, is suited for automatic cycling of aluminum die castings. Its features include removable sections on either side and an automatic kicker pin for positive ejection of molded products. It also has ball-bearing seated leader pins; a removable solid pillar post in back which gives added support to the die;



additional locking pins to assure that the unit does not spread under pressure; and an arrangement of offset alignment screws to further assure positive insertion.

Richards Tool & Mold Co., 2715 Lathrop Ave., Racine, Wis. **Circle 457**

RTV Silicone Rubber



NOW IN 1-LB. SIZE!

General Electric's liquid silicone rubber that cures at room temperature to form a flexible solid now comes in a new 1-lb. minimum order size.

New 1-lb. jar makes it easy to mix up small batches — less waste for infrequent users, more economy for smaller users.

Ideal for potting, sealing, caulking, encapsulating, and flexible molds, G-E RTV silicone rubber has excellent electrical properties. Usable over temperature range of —65°F to 600°F.

New 1-lb. size is available in 6 viscosities, from easily pourable to thick paste.

For full information, contact the distributor nearest you:

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Electrical Specialty Co.
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Chicago
Federal Insulation Co.
549 W. Randolph St.
Detroit
Insulation & Copper Sales
15605 Woodrow Wilson
Jersey City
Smooth-On Mfg. Co.
572 Communipaw Ave.
Floral Park, Long Island, N. Y.
Punt, Incorporated
160 Woodbine Ct.
Philadelphia
Smith of Philadelphia
1024 Race St.
Chagrin Falls, Ohio
Electrolock, Inc.
28 North Main St.

or write: General Electric Company, Silicone Products Dept., Section H958, Waterford, N. Y.

GENERAL ELECTRIC
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HOW DO YOU FABRICATE SPACE-AGE METALS?

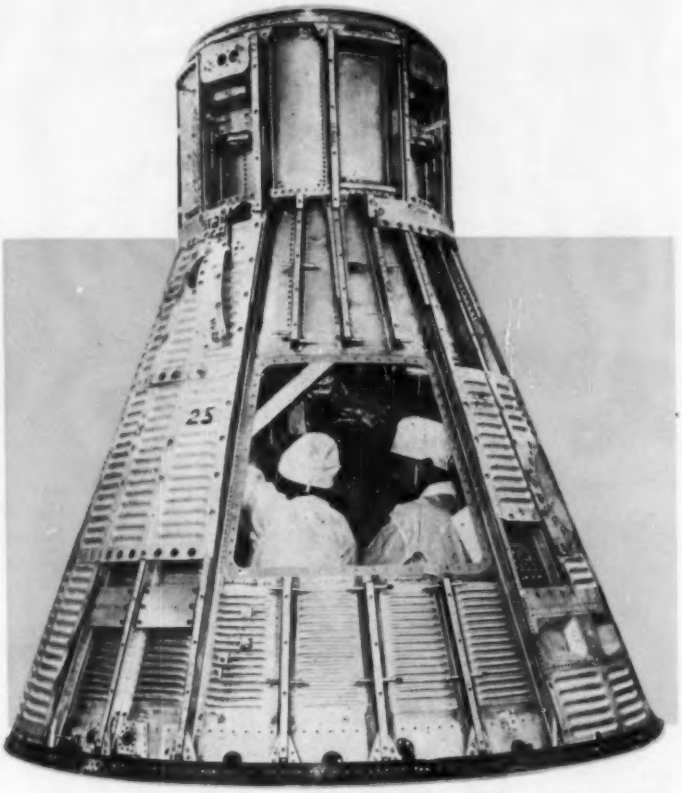


Photo courtesy of McDonnell Aircraft Corp.

THIS IS THE CAPSULE that Gus Grissom rode into space a few months ago. It was built by McDonnell Aircraft. The framework and double skin are of titanium—a material that was in the "exotic" category just a few years back. Titanium is one of a large family of Space-Age Materials that, because of their hardness, strength and temperature resistance are ideal for rockets, missiles and spaceships. Some of the others are tantalum, niobium, stainless steel, columbium and a host of special alloys. These materials are new to industry. They are difficult to form, to machine, to join. Nevertheless, tool and manufacturing engineers are learning to fabricate them in quantity.

If you want to know more about manufacturing with Space-Age Materials, we suggest you attend the ASTME Creative Manufacturing Seminar "Manufacturing with Space-Age Materials." The dates: October 10-11, 1961. The place: the Sheraton Hotel, Philadelphia, Pa. The fee: $45 to ASTME members, $60 to others. If you'd like to attend, we suggest that you write us today, enclosing a check for the full registration fee. Enrollment is limited and applications are accepted on a first-come, first serve basis. Write to: ASTME Creative Manufacturing Seminar, 10700 Puritan Ave., Detroit 38, Mich. Your registration will be promptly confirmed.

ASTME CREATIVE MANUFACTURING SEMINARS HAVE THE ANSWERS!

Men at Work

Paul Goerz Langfeld

Frederick C. Kroft

PAUL GOERZ LANGFELD (pictured) has been elected president of Carl Zeiss, Inc., New York agents and distributors for Carl Zeiss optical and scientific instruments and Zeiss Ikon cameras. He succeeds Karl A. Bauer, who has been president of the company since 1925. Langfeld resigned as president of Pfaff International Corp., also of New York, where he directed Western Hemisphere operations, to assume his new post. Previous experience has been with C. P. Goerz American Optical Co. and Eastman Kodak Co.

FREDERICK C. KROFT (pictured) has been appointed staff assistant to the president of Haynes Stellite Co., New York City. Kroft, formerly works manager, joined the firm in 1936 and worked in the grinding department and chemical laboratory. He later became a junior research engineer, assistant technical director and superintendent of inspection, process and quality control. He will be located in New York.

Hanson-Whitney Co., Hartford, Conn., has announced the appointment of AUGUSTUS VOGEL as vice president and director of sales. He will be in charge of the sales and distribution of all of the company's products.

New vice president in charge of sales of Bronze Bearings, Inc., Chicago, is JACK F. HAYES (pictured). He was formerly associated with Bound Brook Bearing Corp. of America and with Amplex Div. of Chrysler Corp.

Appointment of FRED H. EDGAR (pictured) as division vice president of aluminum sales of the metals division has been announced by Olin Mathieson Chemical Corp. He is currently director of aluminum extrusion operations. Edgar joined Olin in 1957 as regional aluminum sales manager in Detroit after having served for 24 years in various engineering and sales capacities with other aluminum companies.

The following changes and promotions have been announced by the George K. Garrett Co. of Philadelphia and Ellwood City, Pa. FRANCIS J. BOROWSKY, with Garrett for 28 years, has been elected president. He was formerly executive vice president. J. DONALD CLARK, former general manager, has been promoted to vice president and secretary.

JOHN SOMERSET (pictured), sales manager of the Gleason Works, Rochester, N. Y., was recently named a vice president. He began working at Gleason in production control in 1937 and later became a sales manager. On January 16, 1959, he was appointed assistant sales manager.

Newly appointed western division manager for the Truarc Retaining Rings Div., of Waldes Kohinoor, Inc., Long Island City, N. Y., is JAMES A. D'ERRICO (pictured). He succeeds Mel S. Nielsen. D'Errico joined Waldes last May as western manager of the company's aircraft products division and will continue to serve in that capacity. In his new position he will be responsible for sales of Truarc retaining rings, assembly tools and the Waldes QAF stressed panel fastener on the West Coast. His headquarters will be in Los Angeles. His appointment was effective Aug. 15.

THOMAS A. WILLIAMS has been appointed vice president and general manager of Dynaco Mechanisms, engineering subsidiary of Dynamic Gear Co., of Amityville, N. Y., and Van Nuys, Calif. Williams was formerly chief engineer of Dynamic Gear.

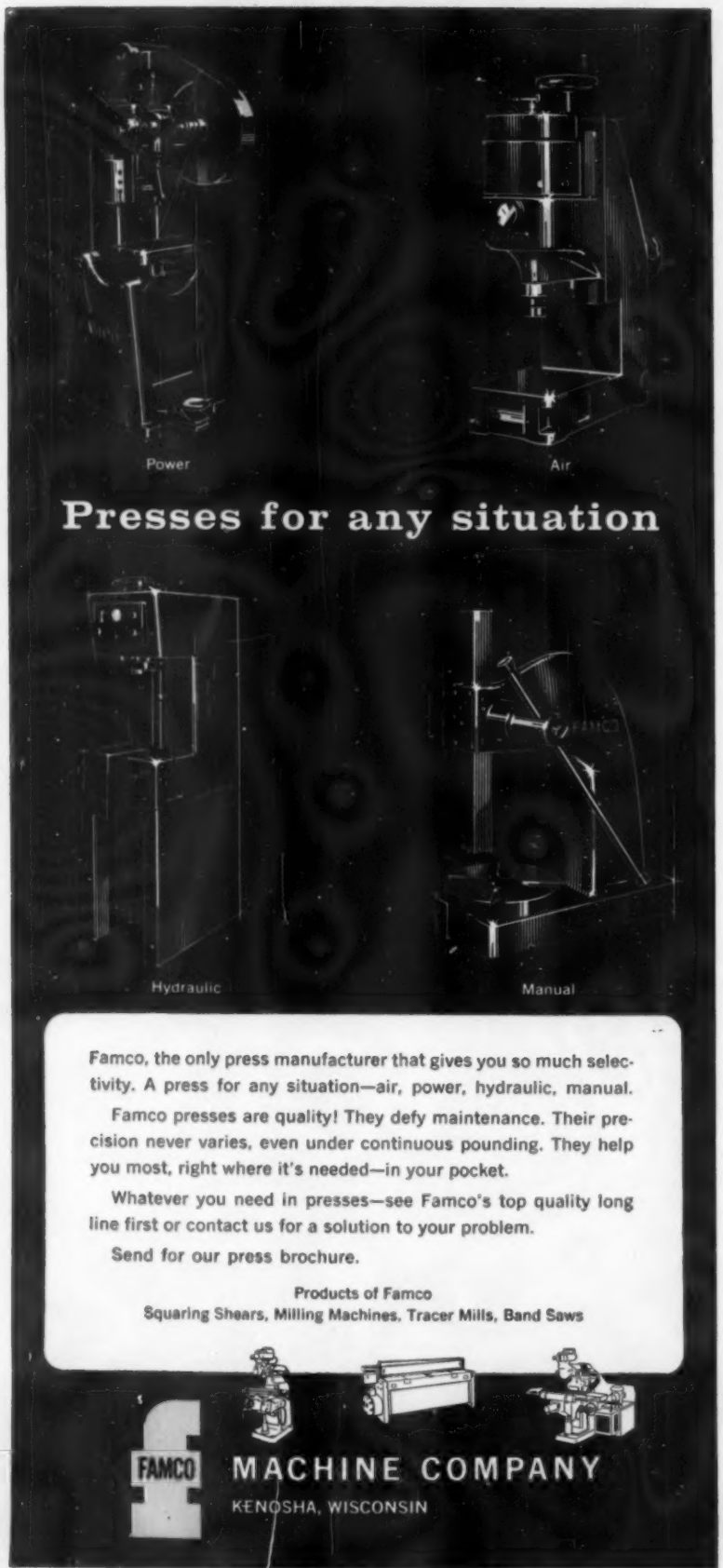
The board of directors of Hexcel Products Inc. recently announced the election of WILLIAM S. POWELL as president and chief executive officer of the Berkeley, Calif., company. Powell was until recently senior vice president in charge of the various manufacturing subsidi-

Jack F. Hayes

Fred H. Edgar

John Somerset

James A. D'Errico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Presses for any situation
Hydraulic
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Famco, the only press manufacturer that gives you so much selectivity. A press for any situation—air, power, hydraulic, manual.
Famco presses are quality! They defy maintenance. Their precision never varies, even under continuous pounding. They help you most, right where it's needed—in your pocket.
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Products of Famco
Squaring Shears, Milling Machines, Tracer Mills, Band Saws
FAMCO
MACHINE COMPANY
KENOSHA, WISCONSIN
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Men at Work

aries for Consolidated Freightways, Inc., Menlo Park, and, prior to that, the resident partner in San Francisco of the Booz, Allen & Hamilton management consultant firm.

LaVerne J. Tobin, California businessman and executive pilot for three California governors, has been named vice president for sales by American Orbitronics Corp. Tobin will also serve on the board of directors of the firm which manufactures missile components from exotic metals. He formerly owned and operated a building material supply firm and was a partner in Lunium Co. In addition to extensive service as a World War II pilot, the new vice president has been deputy chief of the operations and training branch, as well as chief of the maintenance and engineering section in the Military Dept., State of Calif.

Clayton F. English, executive vice president and treasurer of Sturtevant Mill Co., has been elected chairman of the board, succeeding William T. Doyle. English, who joined the firm in 1947 as production manager, became executive vice president in 1957 and was named treasurer in 1958. Prior to joining the Dorchester, Mass., manufacturer of dry processing equipment, English held a management post with the shipbuilding division of Bethlehem Steel Co.

Gisholt Machine Co., Ltd., of Worcester Park, Surrey, England, has appointed S. W. Perkins to its board of directors. Perkins is a director of Wickman, Ltd., sole agents in the United Kingdom for Gisholt machines.

Robert Linquist has been appointed to the executive post of vice president of engineering at Security Valve Co., located in South Pasadena, Calif. He will be chiefly responsible for the firm's engineering and development effort in the field of control and shutoff valves with the associated controls and actuators. Linquist's background includes employment with the Annin Co., North American Aviation, Hyster Co., Boeing Airplane Co. and Pan American World Airways.

C. M. Hargraves, manager of the industrial equipment division of R. C. Mahon Co., Detroit, has been made a vice president. He has been with the company for more than 30 years, serving in various technical, management, sales and administrative positions.

Five changes in management personnel at Leeds & Northrup Co., Philadelphia,

were recently announced. DONALD E. MOAT (pictured), presently vice president and director of marketing, becomes vice president of government and foreign relations. JOHN F. QUEREAU (pictured), presently vice president and director of manufacturing, becomes vice president and director of marketing. In manufacturing, ELWOOD F. ROGGE becomes director of manufacturing; J.

Donald E. Moat

John F. Querean

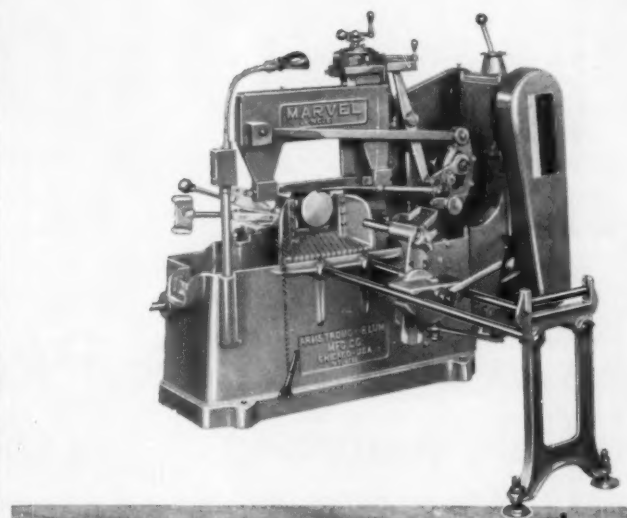
FREDERICK SCHOCK, presently manager of the order control division, becomes in addition local manager at North Wales; and WILLIAM M. FEELEY becomes manager of the plant engineering and services division.

The appointment of W. D. TREAT as president and general manager and ALVIN L. BECKER as chief engineer was recently revealed by Aero-Flex Corp., San Diego. Treat has previously been associated with Marman Div. of Aeroquip Corp., the Precision Sheet Metal Co. and the Martin Co. Becker has worked with the Marman Div. for the past eight years.

In his new position as vice president in charge of sales, LAGRANGE WORTHINGTON will be responsible for coordinating all trade association and convention activities for the Rolled Steel Corp. He will also operate as management representative at the customer sales level for the Skokie, Ill., firm. He joined the corporation as a company sales representative in 1951 and, in 1957, was promoted to regional sales manager.

Appointments of three new divisional vice presidents, a director of product planning and a technical advisor in automatic programming have been announced by Minneapolis-Honeywell's Electronic Data Processing Div. J. ERNEST SMITH, formerly vice president of the engineering department, has been named a vice president with responsibility for future research and development activities and scientific liaison with other Honeywell divisions. Smith's successor is JOHN W. ANDERSON who was formerly manager of Honeywell's inertial guidance plant at St. Petersburg, Fla. JOHN R. LENOX, previously vice president of the operations department, also has been appointed a vice president with responsibility for manufacturing, industrial relations, plants and property, procurement, field service, systems test and manufacturing liaison with other divisions.

RICHARD H. BLOCH becomes the division's new director of product planning with special responsibility in the field of advanced logic and systems development. RICHARD F. CLIPPINGER has been named technical advisor to the headquarters staff with major responsibility in the area of automatic programming development.



OBSOLETE ?

Emphatically no—not when a Marvel Hack Saw like this one can cut 4600 blanks of 3¼" round 303 stainless steel for just 1½ cents blade cost per cut—not when these 4600 blanks were cut-off at the rate of 20 pieces per hour, floor to floor! And this is typical production performance at that.

Obsolete? This Marvel Hack Saw Machine is as modern in performance as the next atomic powered submarine that will slide down the ways!

If you want faster cutting, the Marvel Hack Saw has speed to spare; accuracy of cut is assured by the rugged construction of the machine itself; blade cost, in many cases is less than 1¢ per cut.

When you consider these advantages and their low initial cost, Marvel No. 6 and No. 9 Series High Speed Heavy Duty Ball Bearing Hack Saws, as we build them, are your best cutting-off equipment buy today.

We can prove our point by demonstrating Marvel Sawing efficiency on your own work, without any obligation on your part. Besause we have consistently built both Hack Saws and Band Saws for more than 40 years, we will give you an unbiased recommendation.

Catalog C-60 illustrates and describes the complete line of Marvel Sawing Machines. Write for your copy.

MARVEL Metal Cutting SAWS

BETTER MACHINES
BETTER BLADES

ARMSTRONG-BLUM MANUFACTURING CO. • 5700 Bloomingdale Avenue • Chicago 39, Illinois

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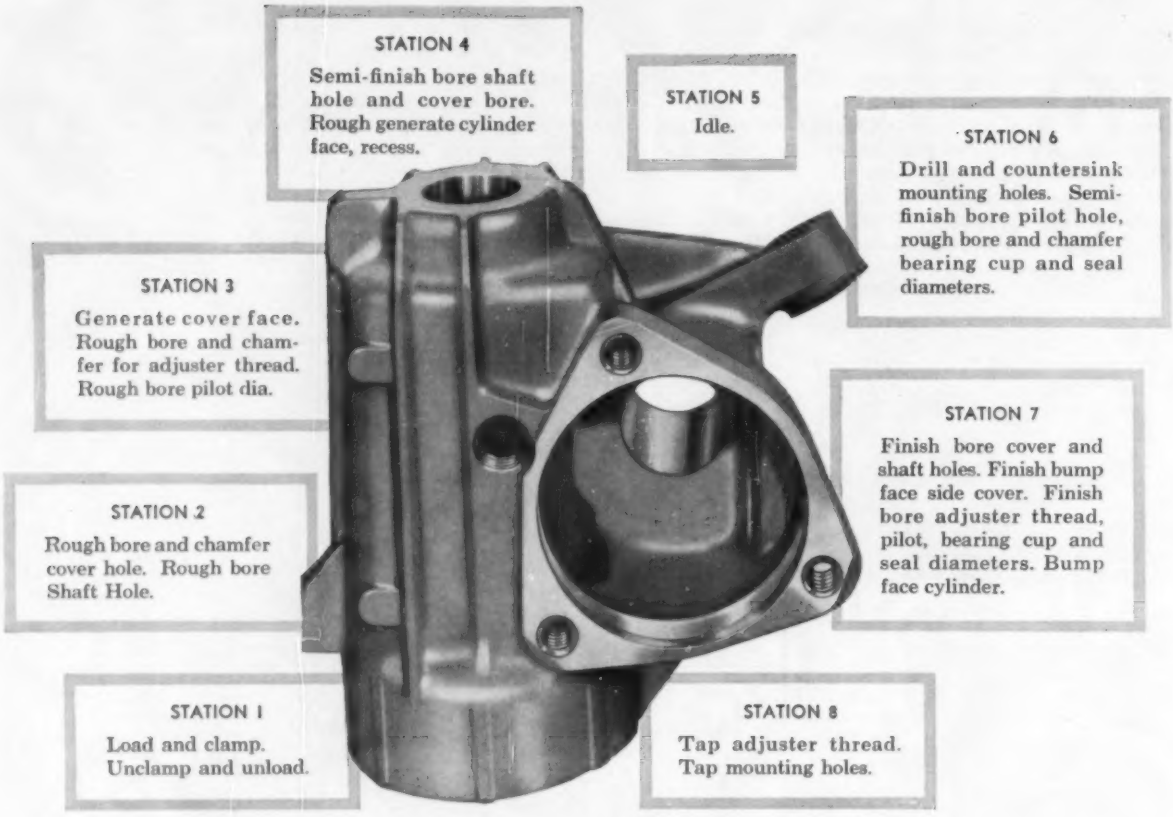
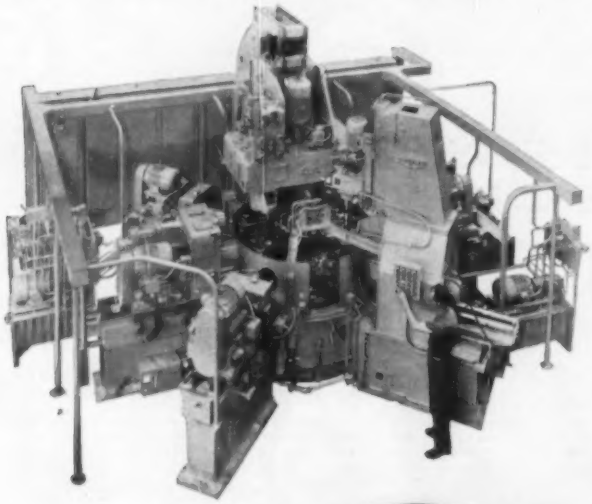

STATION 4
Semi-finish bore shaft hole and cover bore. Rough generate cylinder face, recess.
STATION 5
Idle.
STATION 6
Drill and countersink mounting holes. Semi-finish bore pilot hole, rough bore and chamfer bearing cup and seal diameters.
STATION 3
Generate cover face. Rough bore and chamfer for adjuster thread. Rough bore pilot dia.
STATION 7
Finish bore cover and shaft holes. Finish bump face side cover. Finish bore adjuster thread, pilot, bearing cup and seal diameters. Bump face cylinder.
STATION 2
Rough bore and chamfer cover hole. Rough bore Shaft Hole.
STATION 1
Load and clamp. Unclamp and unload.
STATION 8
Tap adjuster thread. Tap mounting holes.

153 Aluminum Steering Gear Housings per hour

automatically processed on this GREENLEE Machine



This Greenlee 8-Station Horizontal and Vertical Spindle Machine is establishing some excellent performance records for a leading automotive manufacturer. The 52 inch table carries 8 work fixtures. Each has power clamping. To insure rigidity and accuracy, the table is clamped hydraulically metal to metal. Indexing is fully automatic. Cycle time is 23.5 seconds. Like all Greenlee machines it's built for long, continuous service. Can be modified economically if desired. Have our representative give you complete information.

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WITH THE FUTURE IN MIND

PRODUCTION MACHINERY

GREENLEE BROS. & CO.

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DIE CASTING MACHINES • TRIM PRESSES • HYDRAULIC AND HAND TOOLS • COMMERCIAL CASTINGS

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BUILDING-BLOCK UNITS are used for special production machinery or for converting existing machines into individually designed units. Precision Spindle Div., Standard Electrical Tool Co. **(Circle 501)** . . . A 34-page brochure illustrates and describes a line of equipment for all phases of tube production including coil handling, strip joining, strip guiding, strip forming, tube welding, tube finishing and tube cutoff. McKay Machine Co. **(Circle 502)** . . . Three approaches to power press modernization—complete engineering of new press drive systems; combining new power transmission units with reconditioned components; and adding new power transmission components to existing drive systems—are compared in an eight-page brochure. Fawick Corp. **(Circle 503)** . . . Standard nomenclature for construction of industrial brushing tools is covered in a report designed to facilitate communication between users and producers. American Brush Manufacturers Assn. **(Circle 504)** . . . A new multiple second operation machine reduces costs in most secondary machining operations and eliminates the need for hand screw machines, drill presses, light milling machines, tapping machines and single-purpose machines. Standard Tool & Mfg. Co. **(Circle 505)**

Automation, Mechanization

The meaning of numerical control and the use of punched tape in machine tool applications are explained in a 32-page booklet. Friden, Inc. **(Circle 506)** . . . Electric vibrators designed to keep hard-to-flow materials moving freely in hoppers, tracks, bins and chutes and vibratory pedestal drives for in-line track installations, trough feeders and vibratory feed rails are described in a four-page brochure. Automatic Feeder Co. **(Circle 507)** . . . An approach to automation based upon unit mechanization of specific or related work functions, rather than the fully automatic production line concept, is detailed in a 12-page brochure. Jered Equipment Co. **(Circle 508)** . . . A high-speed magnetic counter gives remote indication of equipment operation. Veeder-Root Inc. **(Circle 509)** . . . A positioning control—consisting of a position command or setter, an error detecting amplifier and a position feedback—allows only one part in 30,000 error. Jordan Controls, Inc. **(Circle 510)** . . . A pressure regulator has a high-gain servomechanism which permits use of downstream pressure for piloting. Lexington Controls, Inc. **(Circle 511)**

Boring, Drilling, Tapping

New tools included in a 48-page catalog of drill presses, grinders, cutoff machines, bandsaws and belt and disk surfacers are a 20-inch drill press with planetary gear spindle pulleys for extra-slow speed operation, a 17-inch power feed drill press and a 7-inch standard grinder. Walker-Turner Div., Rockwell Mfg. Co. **(Circle 512)** . . . Individual drill jig bushing requirements can be determined quickly with the aid of a handy speed selection chart. Acme Industrial Co. **(Circle 513)** . . . Built to machine massive pieces such as heat exchanger plates and engine bases, a new 19-inch column, traveling open-side boring and drilling machine also handles smaller work set up in one or more areas while parts are being machined in others. The machine is numerically controlled. American Tool Works Co. **(Circle 514)** . . . Three types of boring tools allow adjustments in tenths without loosening or tightening any screws. Briney Mfg. Co. **(Circle 515)**

Cleaning, Plating, Painting

Nineteen basic types of electroplating, polishing and spray painting systems are illustrated in a four-page brochure. J. Holland & Sons, Inc. **(Circle 516)** . . . "The 3 Essential Steps in Cleaning Steel Before Electroplating" gives detailed outlines of specific procedures; names materials, concentrations, temperatures and treatment times; and illustrates the mechanics of both direct current and reverse current electrocleaning Oakite Products, Inc. **(Circle 517)** . . . An eight-page guide details the known and little-known causes of rust, the six factors vital to successfull rust control, the many specialized rust prevention products which are available and methods of selecting the proper rust preventive for specific operations and degrees of control. Magnus Chemical Co., Inc. **(Circle 518)** . . . The theme of a booklet is that the removal of high-resistance oxide films from aluminum—in preparation for resistance welding—is most simply and efficiently accomplished with chemical methods. Oakite Products, Inc. **(Circle 519)**

Cutting Tools

Recent additions to a line of tungsten carbide tooling include disposable insert turning tools, inserts in both ground and ground-and-honed grades, and a profile toolholder for copying lathe applications. Sandvik Steel, Inc. **(Circle 520)** . . . Carbide-tipped tools, blanks, inserts and holders are detailed in a 36-page catalog. Besly-Welles Corp. **(Circle 521)** . . . A 24-page catalog, made to fit neatly into a machinist's tool box for a ready reference guide, gives descriptions and proper operating speeds for miniature high-speed steel end mills and router bits. Woodson Tool Co. **(Circle 522)** . . . Applications for ceramic tooling include machining materials such as plastics, rubber, cast iron and hardened steels. Vascoloy-Ramet Corp. **(Circle 523)** . . . A company publication contains an article entitled "V-R Solves Machining Problems of Space Age Metals." Vascoloy-Ramet Corp. **(Circle 524)**

Electric Motors, Controls, Drives

"Controlled Speed System," covering 12 typical systems, discusses advances made in central control instrumentation and panel design and in signal transmission methods within process-controlled automatic systems. U. S. Electrical Motors Inc. **(Circle 525)** . . . NEMA size 3 and 4 magnetic contactors and starters control polyphase motors with ratings to 50 hp, 600 volts and 100 hp, 600 volts, respectively. General Electric Co. **(Circle 526)** . . . A 7-inch-diam selector disk makes the customer's job of selecting the right circuit breaker to fit his needs easier. Westinghouse Electric Corp. **(Circle 527)** . . . Available in horsepower ratings from 50 to 2500, a line of magnetic adjustable speed drives meets varied requirements

such as those for draw benches, extruders, wire drawing machinery, calenders, rolling mills and pumps. Louis Allis Co. **(Circle 528)** . . . Shell type motors are available in open, enclosed or liquid-cooled models with ratings from ½ to 150 hp. Louis Allis Co. **(Circle 529)** . . . An equipment system for cold-strip steel rolling mills utilizes X-ray sensing gages and static control to automatically keep strips on gage. General Electric Co. **(Circle 530)**

Fastening, Joining

An expanded line of flexible cushion couplings that absorb vibration and compensate for all combinations of shaft misalignment and end float is described in a 24-page bulletin. Dodge Manufacturing Corp. **(Circle 531)** . . . A four-page folder illustrates four simple steps which assure maximum clamping force and eliminate failures caused by substandard tightening. Skidmore-Wilhelm Manufacturing Co. **(Circle 532)** . . . A new high-strength stainless steel socket-head capscrew family, rated at an increased minimum tensile strength of 125,000 psi at room temperature, is described in a technical bulletin. Standard Pressed Steel Co. **(Circle 533)** . . . Helical spring lock washers compensate for the causes of looseness in bolted assemblies. Mellowes Co. **(Circle 534)** . . . A line of self-locking fasteners replaces cotter pins, keys, solid pins, taper pins, wrist pins and pivots and can substitute for many other types of fasteners in hinge, laminating, positioning or axle applications. Standard Pressed Steel Co. **(Circle 535)**

Finishing, Grinding

"Grinding Stresses: Cause, Effect and Control" is comprised of collected papers based on research sponsored by the Grinding Wheel Institute and the Abrasive Grain Assn. at Mellon Institute. Write on company letterhead to the Grinding Wheel Institute, 2130 Keith Bldg., Cleveland 15, Ohio . . . A line of disk grinding machines includes models for grinding all kinds of parts from gage blocks and bathtubs to coil springs and cylinder heads. Materials that can be ground include ferrous and nonferrous metals, rubber, glass, concrete and carbide. Besly-Welles Corp. **(Circle 536)** . . . Information on materials and compounds for such finishing operations as buffing, burring, polishing and stain finishing is condensed in a four-page guide. Lea Manufacturing Co. **(Circle 537)** . . . A 20-page book shows details of Tschudin universal grinders. Alina Corp. **(Circle 538)** . . . An electrolytic cutter and tool grinder grinds a variety of carbide cutting tools such as face mills, end mills, counterbores and reamers. Covel Mfg. Co. **(Circle 539)** . . . Used for grinding and rough finishing all types of metal and metal alloys, resin fiber disks are bonded with an adhesive that improves the disk's stability and increases its heat resistance. Armour Alliance Industries. **(Circle 540)** . . . Four new surface grinding machines cover sizes 8 x 24, 10 x 24, 12 x 24 and 10 x 30 inches. Brown & Sharpe Mfg. Co. **(Circle 541)**

Fluid Power

Common uses of self-sealing couplings in fluid piping systems are explained in a 20-page booklet. Aeroqu'p Corp. **(Circle 542)** . . . Hydraulic high-pressure valves have psi ratings of 3000 and 6000 and are made in globe, check and relief types. Farrel-Birmingham Co., Inc. **(Circle 543)** . . . A bulletin covers several complete lines of air and hydraulic cylinders. Flick-Reedy Corp. **(Circle 544)**

Inspection, Measurement

A bulletin lists optical as well as physical test instruments. Gardner Laboratory Inc. **(Circle 545)** . . . An 11-digit, photoelectric shaft position encoder converts angular shaft displacement into electrical signals for digital readout. A R & T Electronics, Inc. **(Circle 546)** . . . An on-line statistical computer provides a continuous calculation of mean value and standard deviation. It has been successfully used for operation from a thickness gage to show the effect of process changes on these two aspects of the over-all results. Boonshaft and Fuchs Inc. **(Circle 547)**

Lathes

Features and construction details of new three-way bed lathes, which range in swing capacity from 32 to 92 inches, are given in a bulletin. Farrel-Birmingham Co., Inc. **(Circle 548)** . . . A 10-

FROM FIRST CUT TO FINISHED BORE

FASTER
WITH
LEHMANN-FULTON
BORING TOOLS

LEHMANN-FULTON boring tools bring you a complete range of pre-set cutter blocks . . . you move swiftly from one operation to the next. From rough to finish there's no loss of production time in adjusting or resetting.

Whether for standard or special tooling, a LEHMANN-FULTON engineering recommendation is always complete to the last detail. If you need layout or design help . . . LEHMANN-FULTON engineers will be happy to assist you . . . no obligation, of course.

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Standard or Custom Tooling

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page folder covers with diagrams and illustrations the versatility and applications of a method of tracing. Mimik Tracers, Inc. **(Circle 549)** . . . A line of lathes is illustrated and described, including one machine designed specifically for turning crankshafts. Wickes Corp. **(Circle 550)**

Lubricants, Coolants

A new cutting fluid not only aids machining and grinding operations but also eliminates rancidity and controls rust. Cincinnati Milling Products Div. **(Circle 551)**

Materials

Reprint entitled "Design Factors for Plastic Sleeve Bearings" discusses material selection, limiting loads and speeds, fit and clearance, effects of temperature, cold flow and recommended configurations. Cadillac Plastics and Chemical Co. **(Circle 552)** . . . A self-curing, rubber-like material can be used for repairing conveyor belting, hose and other rubber products; making thick or thin gaskets in place; lining chutes, tanks, pumps and other units subject to severe abrasion; making rubber products without heat, pressure or expensive molds; dampening vibration or mounting machinery; and for making non-shrinking caulking compounds. Devcon Corp. **(Circle 553)** . . . A new aluminum casting alloy, which develops a high combination of physical and mechanical properties with extremely high yield strengths, is well-suited for applications where shock loads are superimposed on top of high static loading. William F. Jobbins, Inc. **(Circle 554)**

Materials Handling

Chip-removal problems posed by high-speed machines tools can be solved with chip conveyors. Designed to be mounted as an integral part of the machine, they deliver chips from the chip pan away from the machine and into a scrap box. May-Fran Manufacturing Co. **(Circle 555)** . . . A press room equipment catalog has details and specifications on air and mechanically operated slide feeds, automatic roll reels, stock reels, straightening equipment and scrap choppers. Cooper Weymouth, Inc. **(Circle 556)** . . . A bulletin describes wire handling equipment for continuous wire processing. General Electric Co. **(Circle 557)** . . . Powders for flame coating, plasma jet coating, abrasive powder cutting and other powder feed applications are metered in uniform quantities, free from pulsations and interruptions, with a new feeder. Sylvester & Co. **(Circle 558)** . . . A combination magazine-fed stock reel and bar feeder attachment eliminates loading downtime and provides long feed-out. National Acme Co. **(Circle 559)**

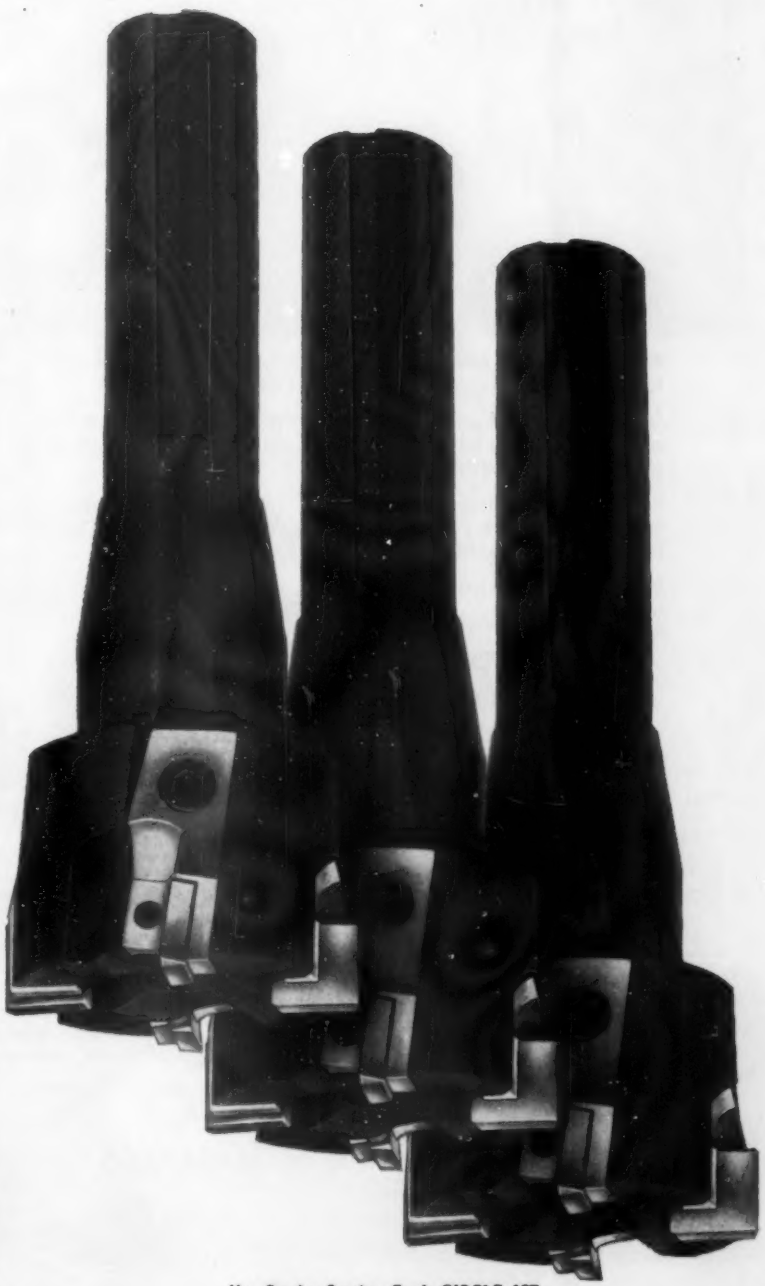
Wider application of the efficiency and economy of Joydex end mills is now possible. They're now available with Bridgeport as well as Weldon shanks. Indexable, throw-away blades provide low cost per edge and fast, easy indexing or replacement. Deep chip flutes increase work capacity. Merely change blades for various rake angles. And . . . *all* Joydex end mills are now priced 30% lower!

Send for details on the *complete* Joydex line of end mills, face mills, and half side mills.

LTC

LOVEJOY TOOL COMPANY, INC.

Springfield, Vermont, U.S.A.



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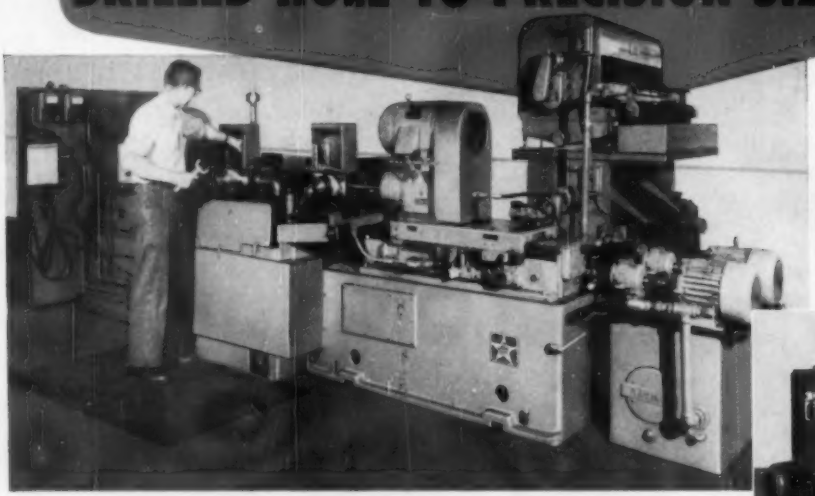
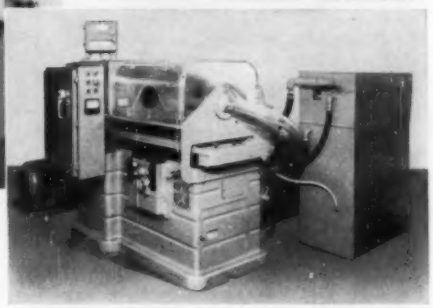
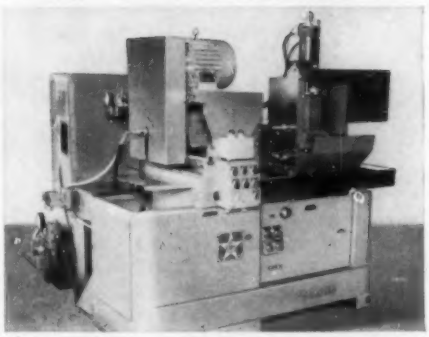
in one operation!

USING Starbore DRILLS, GUN DRILLS AND PRESSURE COOLANT REAMERS.







Shown here are a few examples of Star "rebuilts", with Star-bore tooling, that are making money for their owners.

Star's master machinists will rebuild your present equipment, (or a modern Machine from our stock), to your specification, and with a NEW MACHINE GUARANTEE!

You too can save equipment outlay, improve your competitive position and boost your profits with equipment rebuilt by Star, the precision hole drilling and reaming specialists.

Let us give you an estimate!

Starbore *tooling gives you—*

- ★ LONGER TOOL LIFE
- ★ REDUCED NUMBER OF OPERATIONS
- ★ CLOSER TOLERANCE
- ★ IMPROVED FINISH

Starbore CENTER-CUT TYPE DRILL

Designed for smooth precision drilling of blind or intersecting holes, cored areas, laminated sections or recesses. Off-center pressurized coolant port produces no pin.

Starbore TWO-FLUTE, MULTI-DIAMETER REAMER

In many cases these high precision tools can ream a die cast or rough-cored hole to a highly accurate, finished, stepped hole in one operation. Note ample purging action of pressurized coolant.

Write for detailed literature on Starbore gun drilling tools.

Star Cutter Company

Originators of Accurate Unground-Form Hobs

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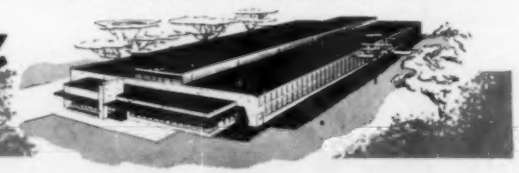


technical shorts

Wetting Graphite—A new process, developed and patented by Ford Motor Co., provides a means of combining or wetting graphite with metal. Iron, nickel, copper, silver, cobalt and alloys of these materials can be combined in combinations varying from 90 to 10 percent of graphite.

Application of the new material is foreseen in the fields of self-lubricating bearings, graphite metal brushes, electrical contacts, seals of all types, resistance elements and nuclear applications. Dixon Sintaloy is licensee in the United States.

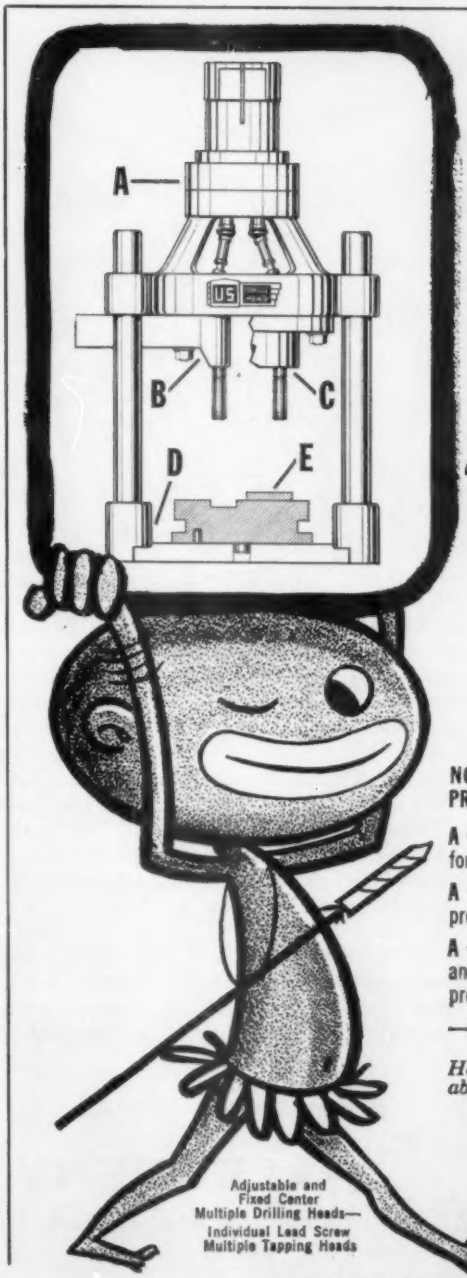
Space-Age Drives—A power package consisting of a motor and high-ratio transmission unit that is completely sealed inside a stainless-steel container has been developed by United Shoe Machinery Corp. The drives are designed to meet specific operating requirements for missiles and space vehicles, and are based on the harmonic-drive principle of transmission, which utilizes deflection of the operating elements to control or convert power.

In one configuration, the stator of the driving motor is internally attached to the end plate of a hollow stainless-steel cylinder. When power is applied through sealed leads in the end plate, the rotor drives a two-lobe generator that produces a harmonic wave in the tubular element. The elliptoidal shape of the generator is transmitted by an antifriction bearing to a Flexspline, causing the Flexspline to engage a surrounding circular spline at two diametrically opposed areas. Rotation of the wave generator causes a rotation of the shape in the Flexspline, thereby producing a continuous interengagement of the teeth in the Flexspline with the teeth on the circular spline. Since the circumference of the Flexspline is less than that of the circular spline, a relative motion is produced. The motor and transmission are protected from the space environment.

Lighter Castings—A new precision-molding technique, pioneered in production by Ford Motor Co.'s Engine and Foundry Div., substantially reduces the weight of cast-iron components used in engines. Enabling foundrymen to precision-mold walls of the block to uniform thickness, the technique reduces the weight of the cast component by eliminating the need for compensation for possible core shifting.

High-Powered Springs—Stainless steel spring wire having a tensile strength of 100,000 psi more than music spring wire has been developed by National-Standard Co. Potential applications for the wire include springs for jet engines, food and beverage equipment and chemical machinery. The higher tensile strength allows designers to specify smaller springs for a given capability or more capability in any given size spring.

Fast Hardening Epoxy—A new epoxy adhesive that cures in 60 seconds at room temperature and in 45 seconds under infra-red heat has been formulated by Allaco Products, Cambridge, Mass. Possible applications include bonding metal to metal, plastic to metal, plastic to plastic or any other porous or nonporous surfaces.



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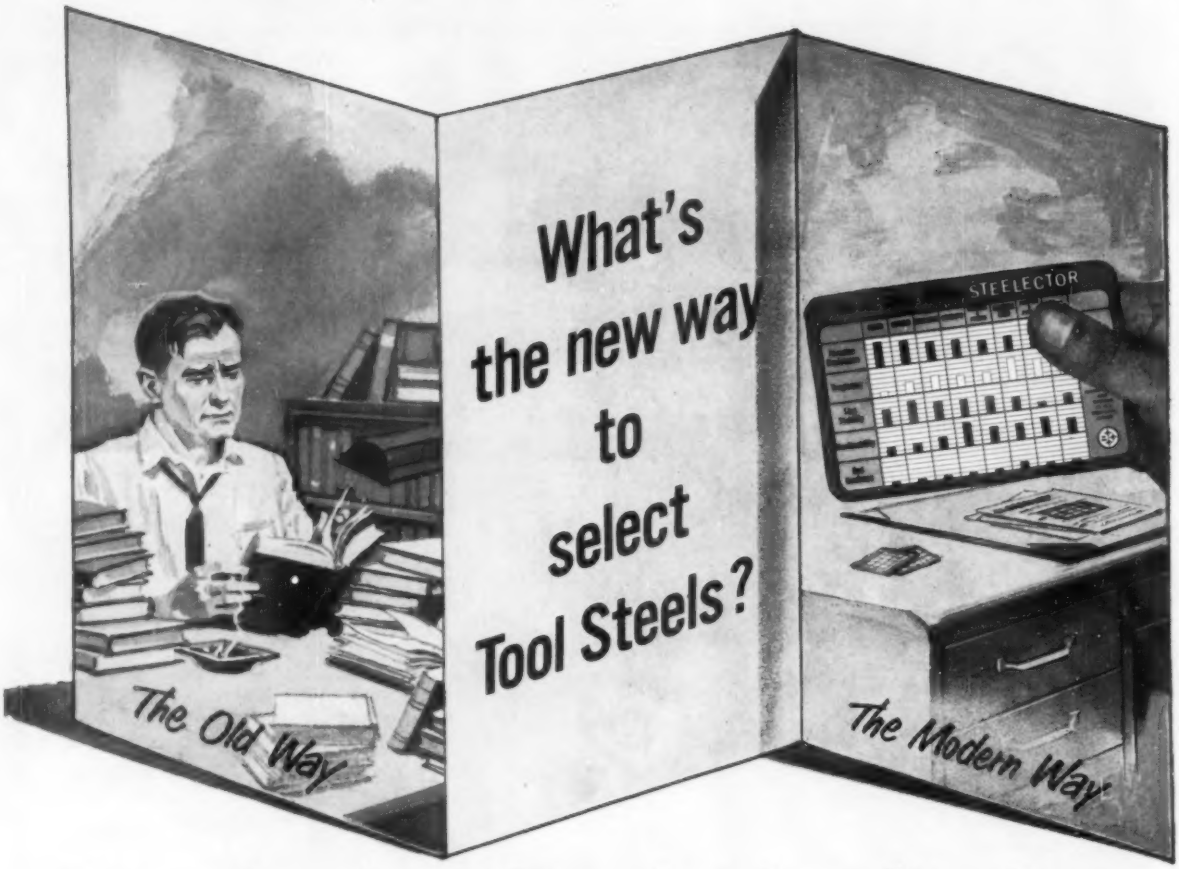

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Bar graphs show how the steels compare so it's simple to check the properties most important to you and pick the grade with the combination of properties you need. The three STEELECTOR Cards list grades that will suit 96 percent of all tool steel applications—as shown by an actual survey of the authoritative A-L Tool Steel Handbook.

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who's meeting and where

Sept. 4-9. Third international conference on analog and analog computation. Sponsored by the INTERNATIONAL ASSOCIATION FOR ANALOG COMPUTATION. Belgrade, Yugoslavia.

Sept. 11-15. Fall instrument-automation conference and exhibit and sixteenth annual meeting. Sponsored by INSTRUMENT SOCIETY OF AMERICA. Biltmore Hotel and Memorial Sports Arena, Los Angeles, Calif.

Sept. 11-15. International industrial conference. Sponsored by Stanford Research Institute and National Industrial Conference Board. Fairmont Hotel, San Francisco, Calif.

Sept. 11-15. SOCIETY OF AUTOMOTIVE ENGINEERS. National farm, construction and industrial machinery meeting. Milwaukee Auditorium, Milwaukee, Wis.

Sept. 14-15. Ninth annual engineering management conference. Sponsored by the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS with the AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Roosevelt Hotel, New York, N. Y.

Sept. 20-21. Industrial electronics symposium. Sponsored by the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS and INSTITUTE OF RADIO ENGINEERS, Boston, Mass.

Sept. 24-27. National power conference. Sponsored by the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS and the AMERICAN SOCIETY OF MECHANICAL ENGINEERS. St. Francis Hotel, San Francisco, Calif.

Sept. 25-28. AMERICAN WELDING SOCIETY. National fall meeting on technological developments in the fabrication and assembly of metals. Hotel Adolphus, Dallas, Tex.

Sept. 25-28. ASSOCIATION OF IRON AND STEEL ENGINEERS. National convention. Penn-Sheraton Hotel, Pittsburgh, Pa.

Sept. 28-29. AMERICAN PRODUCTION AND INVENTORY CONTROL SOCIETY. National conference and technical exhibit. Pick-Congress Hotel, Chicago, Ill.

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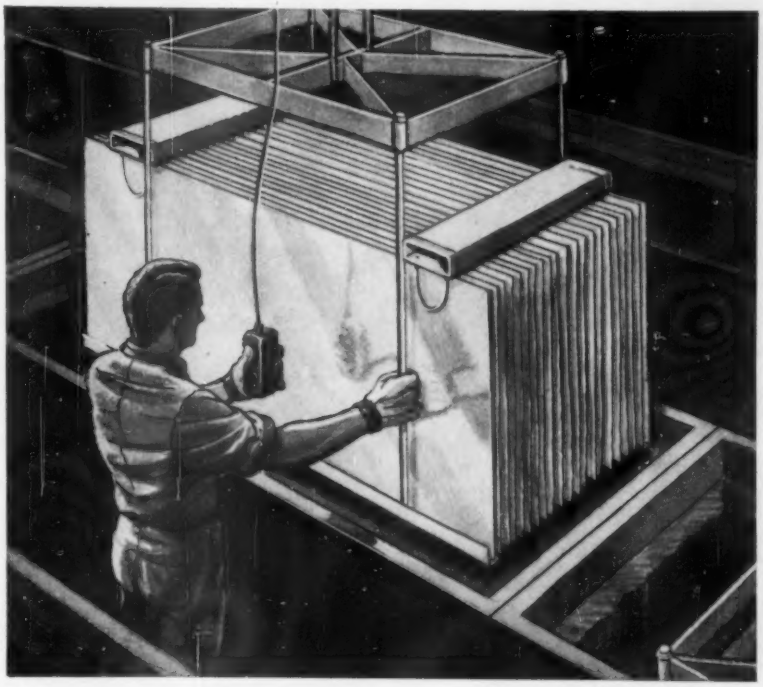

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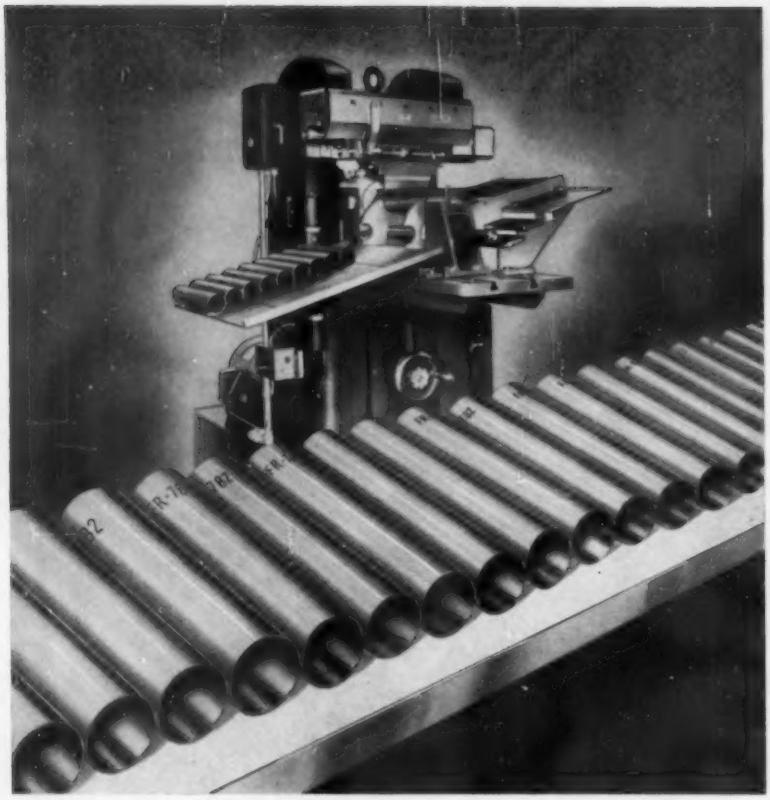

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ENGINEERING BOOKSHELF

PROCEEDINGS OF THE SIXTH CONFERENCE ON MAGNETISM AND MAGNETIC MATERIALS —*Sponsored by the American Institute of Electrical Engineers and the American Institute of Physics. McGraw-Hill Book Co., Inc. Price $10. 395 pages.*

Papers on theoretical, experimental and engineering aspects of magnetic materials and their applications are combined in this book. Prepared by experts in physics, chemistry, mathematics and other related disciplines, the papers discuss the most recent advances in the use of magnetism and magnetic materials.

VALUE ENGINEERING, VOLUME 2—*Edited by Richard S. Mandelkorn. Engineering Publishers. Price $7.50. 167 pages.*

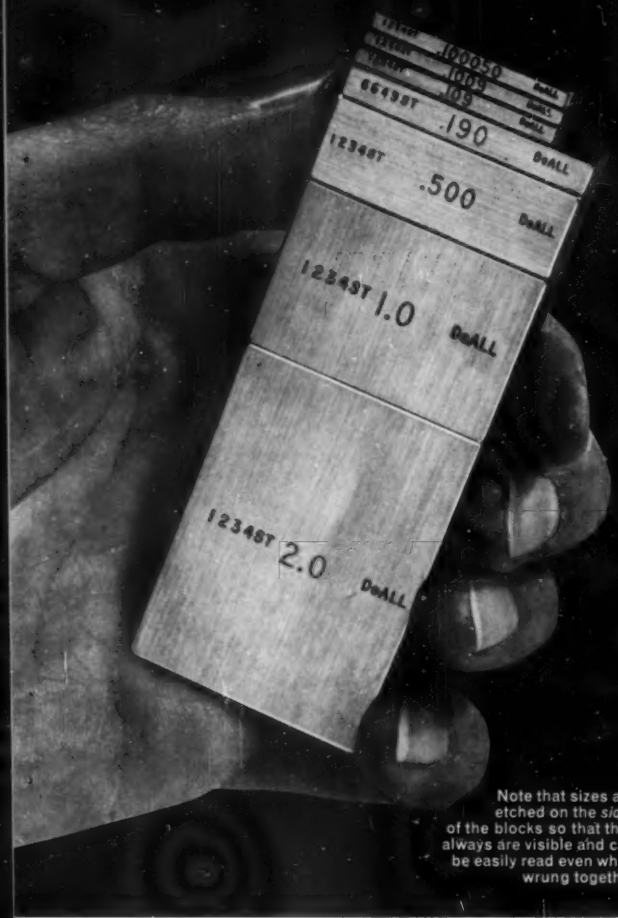
This book, based on the Second Electronic Association Conference on Value Engineering, attempts to solve the problem of how business men can meet increasingly strong competition from domestic and foreign sources. Stressing the organized approach to the problem of improving the value of a product, it shows how principles of value engineering are used to reduce the cost of manufactured products while maintaining, and even improving, the quality.

THE CONSULTING ENGINEER—*By C. Maxwell Stanley. John Wiley & Sons, Inc. Price $5.95. 258 pages.*

Divided into two parts, this book presents professional and management problems involved in the practice of consulting engineering. Part one, emphasizing external matters, deals with the function of the consulting engineer and his relationships with clients and others. Part two discusses internal problems such as organization, personnel and plant facilities.

MAGNETIC CONTROL OF INDUSTRIAL MOTORS, *Part I—By Gerhart W. Heumann. John Wiley & Sons, Inc. Price $9. 273 pages.*

First of three volumes, this book is a study of the various magnetic devices and accessories used for control of electric motors. Industrial a-c and d-c motors are analyzed, each type being studied in conjunction with its controllers. Circuitry and economic factors related to controller selection are also discussed in detail.



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Extraordinary stability—independent laboratory tests show no measurable dimensional change after 24 months.

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0.9 RMS surface finish—far superior to that available on blocks of any other material or make; assuring greater accuracy, easier wringability, and maximum wear life.

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LOW PRICE. When you consider the greatly extended wear life, the unequaled finish, the workable coefficient of expansion, the ultra-stable accuracy, and the ease of wringability of DoALL stainless steel gage blocks, you will find that they give you more practical value, dollar for dollar, than any other blocks you can buy. For example, a 2" AA grade SS block at $18.25 costs *only $5.75 more* than a standard steel block and *as much as $41.75 less than* a chrome carbide block.

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Field Notes

EXTENSIVE RESEARCH on the development of a method of grading grinding wheels is to be conducted under a contract made by the Grinding Wheel Institute with the University of Michigan. With such a standard method available, the Institute hopes industry will be able to establish standards for grade of grinding wheels which would be the same regardless of the source of wheel manufacture. Work in this area was initiated by Prof. L. V. Colwell of the University's department of mechanical engineering.

John Savage, an Australian mechanical engineer, has been appointed by the New South Wales Government Office, of New York City, to help arrange joint venture manufacturing partnerships between Australia and American metalworking producers. Arthur Denning, commissioner for New South Wales, explained in making the announcement that his organization currently has on file over 50 Australian light-to-heavy engineering companies seeking American know-how and/or capital. He added that about 30 other concerns are interested in similar arrangements.

acquisitions

Coleman Engineering Co., Inc., Los Angeles, has acquired the assets of Speed-D-Burr Corp. By December of this year, the plant of the Wilmington metal product finishers will be more than doubled in size to house operations of Coleman's engineering division. The division manufactures supersonic test track equipment and manages the Hurricane Supersonic Research Site in southwest Utah. In addition to metal finishing, Speed-D-Burr sells finishing compounds and manufactures and services finishing machinery.

Cenco Instruments Corp. has recently acquired the Instru-Coil Co. of Cincinnati. Founded over 30 years ago, the company has been active most recently in the manufacture of coil components for computers. Cenco is a Chicago manufacturer and distributor of scientific apparatus, instruments and equipment.

Branson Instruments, Stamford, Conn., has acquired all outstanding stock of Circo Corp. "This acquisition," stated Branson president Peter K. Bloch, "combines the experience of the Clark, N. J., firm in metal finishing and materials handling with Branson's know-how in ultrasonic cleaning and nondestructive testing."

Sale of the Method X Div. of Firth Sterling, Inc., Pittsburgh, to Elox Corporation of Michigan, Troy, was announced recently by officials of the firms. For the past 10 years, both companies have designed electrical discharge machining units. Elox has concentrated on the manufacture and sale of equipment in the U. S. Method X, on the other hand, has emphasized the development of foreign markets and has directed its activities to developing electrical circuits and licensing machine builders.

name changes

Comcor, Inc., is the new name of the Denver manufacturer of analog computers and computer components formerly known as Computronics, Inc. The new name was announced by David R. Miller, president, concurrent with the appearance of the firm's first national advertising in the trade press and the addition to the company's staff of a marketing manager. He is Robert G. Wieneke.

The name of Patterson Moos Researeh Div. of Leesona Corp. has been changed to Leesona Moos Laboratories, a division of Leesona Corp. According to president Robert Leeson, "The new name better defines our operations in advanced scientific areas, such as energy conversion, at Leesona Moos Laboratories in Jamaica, L. I., as distinct from our research and development work on textile machinery and equipment at the Leesona plant in Providence, R. I."

The name of Unigage Corp. has been changed to Unigage Instruments Corp. The change in name was made to indicate the broad line of measurement and quality control instruments being produced by the Addison, Ill., firm.

mergers

The merger of Atronic Products Inc. into General Atronics Corp., Bala-Cynwyd, Pa., has been announced by David E. Sunstein, president of General Atronics, and George J. Laurent, president of Atronic Products. Atronic Products of Union Hill, West Conshohocken, manufactures signal enhancing equipment and automatic selecting, routing, sensing and control devices and systems for materials handling operations.

moves

Ground-breaking ceremonies took place recently at the site of the new H. J. Ruesch Machine Co. plant in Springfield, N. J. Ruesch—manufacturers of metalworking machinery—has been located at 407 Mulberry St., Newark, N. J., for the past 50 years.

National Automatic Tool Co. has moved all manufacturing of the Natco-Jes/Cal Co. from Fraser, Mich., to Richmond, Ind. Also included in this move was the service-sales office. The company's sales and engineering office has been moved to the Detroit regional sales office located at 14119 Puritan Ave.

new companies

Lester Avnet, president of Avnet Electronics Corp., has announced that the company has taken another step in the automation of the Shaw Process by joining with Foundry Equipment Ltd. of England in the formation and joint ownership of Feco, Inc. Foundry Equipment Ltd.—producers of automated foundry equipment—has developed and is now producing automatic machinery for use in the Shaw Process.

A new company, General Automation Manufacturing, Inc., has been formed by a merger of Portomag, Inc., and its Di-Cor division with General Automation Co., of Detroit. The new firm, with facilities at 1200 E. Maple Rd., Troy, Mich., produces diamond drilling bits and machines, as well as special automated machinery and equipment. Portomag, Inc., producers of portable electromagnetic drill presses, and Di-Cor, Inc., manufacturers of diamond core drills and drilling machines, will operate as divisions of the newly formed company. In addition, a special products division has been established to supply advanced automated machinery and equipment. Principal officers include president, R. R. McLeese, former

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Trade Literature

president of Portomag; vice president of marketing, R. S. Ebbert, former vice president of Portomag; and vice president of engineering and manufacturing, H. C. Ovshinsky, former president of General Automation Co.

Chromium-plated gage blocks is the product line of a new company named A. A. Jansson, Inc. Founded by leading experts in the field, the company is located at 12083 Woodbine in Detroit. A. A. Jansson serves as chairman of the board. The posts of president and secretary-treasurer are being filled by Arnie Lundquist and Eric Lundquist, respectively. Vice president in charge of sales is Walter C. Foote. Jansson formerly worked with the C. E. Johansson Gage Co. and Arnie Lundquist's background includes extensive experience with the Lincoln Park Industries.

association news

To draw attention of the manufacturing public to the special versatility offered by the extrusion process, the Aluminum Assn. has established two awards for design in aluminum extrusions. The first award will go to the most ingenious extrusion and the second to the most noteworthy extrusion converted into a finished part. Details may be obtained from the Awards Committee, the Aluminum Assn., 420 Lexington Ave., New York 17, N. Y.

The names of the top Alloy Casting Institute executives elected for the 1961-62 year have been announced. J. D. Hagans, of the Ohio Steel Foundry Co., was re-elected to the office of president. Elected to the office of vice president was J. W. MacKay of the American Cast Iron Pipe Co. E. A. Schoefer, who is the administrative executive of the Institute, was re-elected executive vice president and treasurer.

Clifford H. Shumaker has been named to serve as president of the American Society of Mechanical Engineers. Chairman of Southern Methodist University's department of industrial engineering, Shumaker will begin his term in June of 1962, following a mail ballot of the membership this fall.

Chester G. Borlet, an executive of the Grand Rapids Brass Co., has been elected national president of the American Electroplaters' Society for 1961-62. He succeeds W. Andrew Wesley.

Engineering Foundation, research department of United Engineering Trustees, Inc., has announced the re-

election of Antoine M. Gaudin as chairman. Gaudin is a professor at the Massachusetts Institute of Technology. Three new directors are Hugh L. Dryden, National Aeronautics and Space Administration; Latimer F. Hickernell, Anaconda Wire and Cable Co.; and Roy A. Kinckiner, E. I. duPont de Nemours & Co.

Miles N. Clair, of Thompson & Lichtner Co., Inc., was elected president of the American Society for Testing Materials. Alfred C. Webber was elected vice president and R. Wade Seniff will continue as senior vice president. Webber is with E. I. duPont de Nemours and Co., Inc., and Seniff the Baltimore and Ohio Railroad Co. New members of the board of directors are Ardrey M. Bounds, Albert G. H. Dietz, Bruce W. Gonser, Wayne A. Kirklin, Gordon M. Kline and James B. Rather, Jr.

new activities

Signing of a licensing agreement covering the manufacture and sale of S-P products by the Compagnie Parisienne d'Outillage a Air Comprime of Paris, France, is announced by D. Lee Bassett, executive vice president of S-P Manufacturing Corp., Cleveland. Equipment involved in the licensing agreement consists of certain nonrotating cylinders, boosters and air/oil tanks of S-P design and manufacture which are used in high-volume-production and automated plants.

The formation of a joint venture called Burndy-Escon, Inc., was announced recently by Burndy Corp., Norwalk, Conn., and by Glass-Tite Industries, Inc., of Providence, R. I. Glass-Tite sold a 50 percent interest in its wholly owned subsidiary, Escon, Inc.—manufacturer of high temperature electrical and electronic connectors—to Burndy Corp. The company will be operated at 725 Branch Ave., Providence.

Westinghouse Electric Corp., Pittsburgh, has organized a new industry systems department for the conception, development, design and sale of complex systems for control of processes in industry. In making the announcement, president Mark W. Cresap, Jr., reported the election of Patrick Conley as vice president with responsibility for industry engineering apparatus, service and the newly created industry systems department.

Benerson Corp., Evansville, Ind., is forming a separate division to continue the firm's work in the design, development and production of automated assembly equipment. The new unit has been named the Benematic Div.

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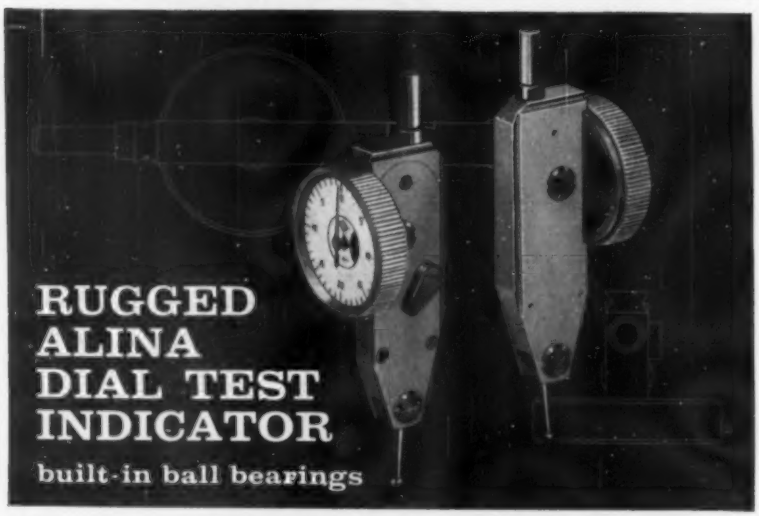

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. . . machinability

To the Editor:

Experiments conducted by Antoni Niedzwiedzki in machinability seem to parallel those of Dr. A. O. Schmidt who published some of his findings in "Effects of Workpiece Diameter on Tool Life," in the April issue of THE TOOL AND MANUFACTURING ENGINEER. I note, however, that Niedzwiedzki, who published his findings in a book, *Manual of Machinability and Tool Evaluation*, (THE TOOL AND MANUFACTURING ENGINEER, Sept. 1960) totally disregards workpiece deflection as a factor in tool wear. Does Niedzwiedzki have any comments on the apparent disagreement between him and Dr. Schmidt?

Arthur Mandel
Sandusky, Ohio

Dr. Schmidt's team does not seem to contest my findings, since they admit that the "diameter alone may have an effect on tool life." They stress the influence of workpiece rigidity, a topic which I disregarded in my experimental work. Thus, there is no disagreement.

In evolving the tool-life formula, which is published in my book, I introduced diameter turned as a new machining parameter. Diameter reduction usually coincides with a drop in workpiece rigidity, of course, especially if workpiece length is constant, as it is in most of my experiments.

Measurement of workpiece diameter is easy, but evaluation of deflection is complex. Thus, my equation is easy to handle, but the addition of deflection would make it most unwieldly. Whether the refinements resulting from this addition would be worthwhile at this time is doubtful.

Antoni Niedzwiedzki
Detroit, Mich.

. . . education

To the Editor:

Your article, "Industry Wants Trained Manufacturing Engineers" by W. Karl Somers is one of the most concise analyses of the needs of industry that I have seen. I was especially interested in the discussion of technical report writing. The ability to write technical reports that get action immediately is one of the most important functions of a tool and manufacturing engineer. Too many engineers, however, look upon their positions as being purely technical.

Technical ability is, of course, a re-

quisite to an engineering career, but equally important is the ability to propose a course of action that will be accepted by management. After acceptance, it is necessary to be able to follow through with clear, concise reports and interdepartmental memos concerning personnel training, indoctrination of production supervision, engineering changes, etc. Every communication must leave the reader with only one possible course of action—to do as he is directed.

Perhaps this sounds ruthless, but today's tooling methods are not for the effete. They require tough-minded engineers well trained in the subjects mentioned in this article.

Name Withheld

. . . manufacturing

To the Editor:

The two-article series, "Revolution in Manufacturing," by T. W. Black effectively points up several important trends. In particular, I find myself in wholehearted agreement with Black's observation that too few college-trained men are working in the tool and manufacturing engineering field.

As these articles point out, we have just begun to conceive of manufacturing processing as a major subject for research and development. Until now, the lion's share of research and development has been oriented primarily towards product development. If accelerated research on manufacturing processing does turn out to be one of the keys to future progress—and I believe it will—the requirements for more broadly educated engineers will undoubtedly grow rapidly.

I would like to underline Black's observation that too often today's manufacturing engineers must spend much of their time solving day-to-day crises on the production floor. Perhaps we need more manufacturing engineers or perhaps some of the engineers we already have can be allowed to focus their attention on long-run developments. Whatever the personnel requirements, top management must plan and arrange financing for a certain amount of continuous long-run development work if the full potential of manufacturing engineering effort is to be realized.

The hidden costs of starting up crash programs or of discontinuing programs because of budget squeezes are tremendous. We seem to realize these things when a long-range product development project is involved; why can't we see that the same factors are at work when the project is a long-run effort in manufacturing research?

Powell Niland
Professor of Management
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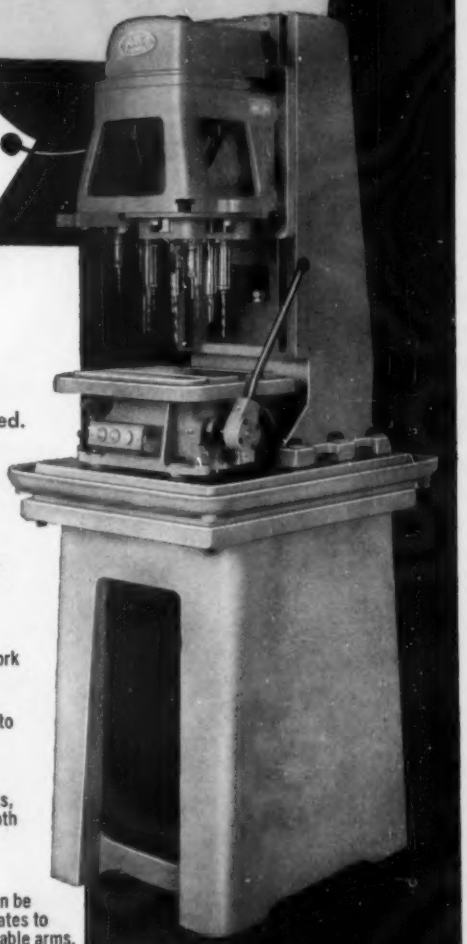

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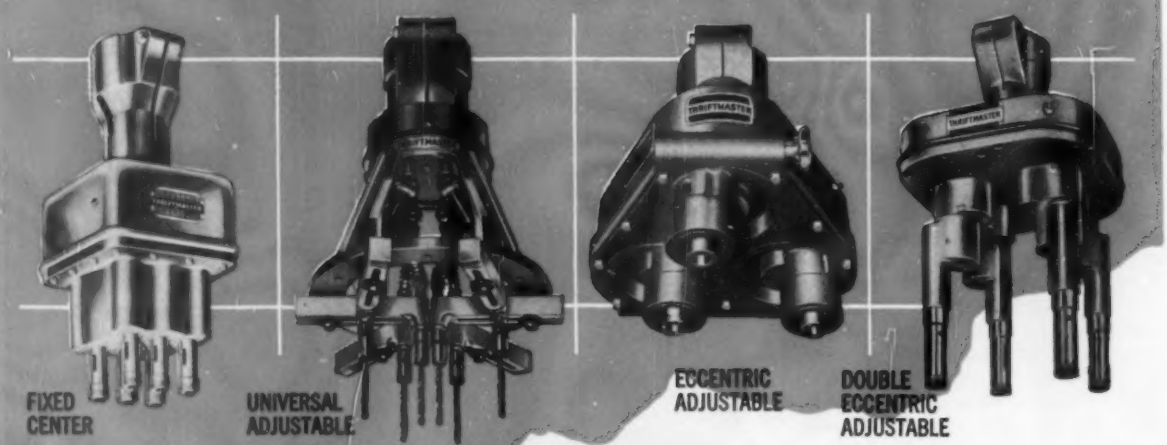

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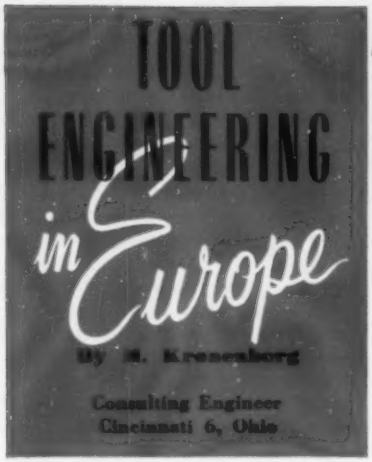


Eccentric Turning

Parts having eccentric journals or bores can be machined in several ways. Machining is sometimes accomplished by adjusting the individual jaws of a three-jaw chuck with the aid of dial indicators. This method, however, is time consuming and should be used only for large lots of small-diameter workpieces. Another method makes use of adapters. The jaws are not in close contact with the periphery of the workpiece. This method is recommended only when the adapters are accurate and the workpieces are relatively short.

H. Gut has observed that the selection of adapters in shop practice is often a hit-or-miss proposition. He has derived mathematical relationships for determining the correct shape and size of the adapters. His findings appear in an article "Das Aussermitte-Drehen mit Hilfe von masshaltigen Beilagen," in *Werkstatt und Betrieb*, Vol. 94, No. 5, 1961, p. 273-274.

Gut differentiates between inside and outside chucking and takes the height of the adapter into consideration; also the part eccentricity, the radii of the workpiece, and the radii and width of the jaws. He gives some simple equations for determining that adapter height which gives the most accurate eccentricity of the workpiece. No guesswork is needed.

Serious errors result if the jaw width is disregarded. This is demonstrated by an example where an eccentricity of 0.8 inch must be produced on a workpiece of 2.4-inch radius, using a chuck with 0.6-inch-wide jaws. The height of the adapter, as found with the equations, must be 1.16 inch. Disregarding the width of the jaws would give an adapter height of 1.10 inch. With the 1.10-inch adapter, the eccentricity would be only 0.75 inch—0.050 inch less than the required eccentricity of 0.8 inch.

The author also discusses formulas for computing the maximum eccentricity that permits safe chucking of hexagonal workpieces and shows that the width of the chuck is important when chucking at inside diameters.

Chipless Machining Survey

A survey of publications on chipless machining methods is given in an article by H. Kubeth, appearing in *Industrie Anzeiger*, Vol. 45, June 6, 1961, p. 33-37. The title of the article is "Abtragende Bearbeitungsmethoden."

The survey covers the years 1954 to 1961 and includes 275 American, English, French, Russian, German and other publications on electroerosive machining, spark machining, electrolytical machining, electron-beam machining and ultrasonic machining.

Turning Titanium

Information on fine turning of titanium is still rarely available in the literature. Thus the work done by P. H. Brammertz is of interest. He has published the results of his investigations in *Industrie Anzeiger*, Vol. 45, June 6, 1961, p. 31. The title of his article is "Neuere Ergebnisse beim Feindrehen von Titan."

As a general rule, the same tool geometry and feed (but not cutting speed) that are used for rough turning of steel can be used for the rough turning of titanium of the same hardness. The author found that this rule does not apply for fine turning. His tests were run on two types of titanium, identified as Ti-6 Al-4 V and Titan 180. The tool geometry has a marked effect on the surface finish of titanium. Best results are obtained with a tool nose radius of 0.040 inch, while larger radii often cause vibrations. All tests were run with this tool nose radius. The surface finish was not affected by the cutting speed, which was varied within a range of about 130 to 650 fpm. The feed had a considerable effect on the surface finish. Increasing the feed from 0.002 ipr to 0.0048 ipr increased the surface roughness at a ratio of nearly 4:1.

The roughness was a minimum when the clearance angle at the tool was 50 deg and increased both for smaller and larger clearance angles as much as 150 percent in the case of a 15-deg clearance angle. A true rake of +5 deg gave the best surface finish. These data are the result of more than 1000 tests.

The tool life-cutting speed relationship could be represented in a double logarithmic field by a straight line covering the range from 530 to 820 fpm. Using lower cutting speeds, the author found that the tool was covered by a fine film of titanium oxide. This film increased the tool life. Only a limited number of tests could be run at low cutting speeds, however. The wear at about 330 fpm was not more than 0.004 inch after 200 min. of cutting.

The author concludes that titanium can be machined to high accuracy and surface finish. The built-up edge is stable at the lower cutting speeds and contributes to fine machining, while it is unstable at higher speeds—as is usually the case with other metals—sticking partly to the workpiece and producing a rough surface.

Electrolytic Machining

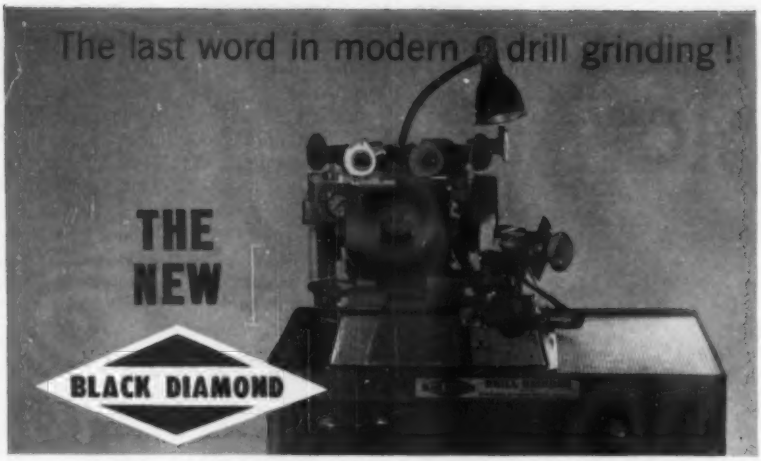
Electrolytic machining should not be confused with electric spark-discharge machining, as pointed out in *Pera Bulletin*, Vol. 14, No. 4, 1961, p. 87-90. The electrolytic process involves the localized and controlled dissolution of the work material. The initial development was directed towards grinding for the purpose of reducing consumption of industrial diamonds. Although diamonds are still consumed in the electrolytic grinding process, wheel life can now be extended three to ten times. Longer wheel life or elimination of diamond wheels is claimed to be a main advantage of electrolytic machining. The article deals also with metal-removal rates and applications of equipment.

An article dealing with electrolytic machining of carbide tools appears in *Maschine*, Vol. 15, No. 4, p. 63. The article, titled "Die elektrolytische Bearbeitung von Hartmetall," is by K. E. Schwarz. He discusses the "Eleform" method of electrolytic grinding, in which a plate with diamond particles immersed in a conductive, highly porous bond is connected to a cathode. Ten to twenty times as much material is removed as when using a conventional diamond grinding wheel.

Machining Welded Parts

Worn machine parts are often repaired by welding material on the damaged surface, which is subsequently machined to size. An article by D. D. Medvedev, published in *Stanki i Instrument*, No. 12, 1960 (translated into English in *Machines and Tooling*, Vol. 31, No. 12, 1960, p. 25-26) discusses the machining of welded areas. The article title is: "Cutters for Machining Built-Up Metal."

Medvedev ran tests on shafts of 4.7-inch diam and 21.6 inch long. Layers of material were applied to these shafts, using electrodes identified as TsN-350. The layers consisted of longitudinal seams composed of 0.22 percent C, 1.52 percent Ni, 0.55 percent Cr and other alloys specified in detail in the article. The material had a troostite microstruc-



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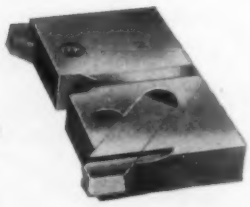

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ture and a Brinell hardness between 363 and 446. The tools had a 10-deg negative true rake and a clearance angle of 12 deg. The tool nose radius was 0.040 inch. Carbide tools were used.

Most of the wear occurred at the tool flank, which could be as large as 0.040 inch without causing breakdown of the cutting edge. (In the United States, such a large wear land is considered economical only with high-speed steel tools.) The dulling of the tools was accompanied by an increase in the radial cutting force, larger deflection of the workpiece and a considerable reduction in the curling of the chips, in comparison with their curvature at the beginning of the cutting test. Dulling of the tools could also be recognized by the formation of lines on the machined surface that damaged the finish.

In rough turning, four different types of carbide tools were used at a depth of cut of 0.078 inch, an 0.011 ipr feed and a cutting speed of 118 fpm. Each tool was run 10 to 16 min. and checked every 2 min. Best results were obtained with T15K6 carbide. When finish turning at 295 fpm, it was found that increased titanium carbide in the tools reduced tool wear. A true rake of −15 deg gave the best tool life and a true rake of −10 deg the best surface finish. T15K6 carbide tools contain 79 percent tungsten carbide, 15 percent titanium carbide and 6 percent cobalt. Hardness is 88 to 90 R_A, and the specific gravity 0.396 lb per cu in.

Production Balancing

The balancing technique has progressed far beyond the mere measurement of out-of-balance forces, concludes H. Hack after looking at developments in this field initiated by the demands of the automobile industry. An article by Hack in *Werkstatt und Betrieb*, Vol. 94, No. 3, 1961, p. 123-129, deals with both low-production and mass-production balancing, with emphasis on automatic and semiautomatic machines. The article is entitled "Auswuchtmachinen fuer die Serienfertigung, insbesonders in der Kraftfahrzeug Industrie."

The machines described are actually combinations of a machine tool with a balancing machine that determines how much material must be removed and where. On one machine, the center of gravity of connecting rods can be shifted by a fully automatic milling attachment. Similar machines, also described in the article, balance crankshafts, brake drums and other automotive parts. These machine tool-balancing machine systems unquestionably save machine time and operator time.

Transistorized Grinding Control

A device for positive control of workpiece dimensions that uses transistors (triodes) has been developed at the Industrial Electrical Equipment Laboratory of the Kuibyshev Institute by A. Ya. Kylagin. He describes the device and its application to grinding operations in an article published in *Stanki i Instrument*, No. 12, 1960. The article, translated into English, appears in *Machines and Tooling*, Vol. 31, No. 12, p. 27-28, under the title: "A Transistor Device for Controlling Grinding to Dimensions."

The device differs from existing instruments in that the customary electronic indicators have been replaced by triodes. They are connected in the phase-sensitive circuit of the booster, regulating alternately through two intermediate relays which in turn give commands to the two motors controlling feed and speed and thus control the workpiece dimensions.

The author claims that the device is considerably simpler in design than existing controls and that it is very small, light and low in cost. He also states that the transistor has a longer life than conventional devices and does not require frequent replacements. The pick-up contacts require considerably less power (2.0 to 2.5 mw) than electronic indicators. A circuit diagram is reproduced in the article. The device is used for automation of cylindrical plunge cut, internal and other types of grinding operations in the antifriction bearing and similar industries.

Twist Drill Grinding

In an article entitled "Verschiedene Spiralbohrer Anschliff Arten und ihre Problematik in der Praxis," P. Troester deals with the various methods for grinding twist drills. The article appears in *Werkstatt und Betrieb*, Vol. 94, No. 3, 1961, p. 138-139. The article reviews the cone shaped point grinding method, with and without point thinning and with recessed portions in the wedge (a method developed in Germany); split point grinding with and without centerline; a modified split point grinding method; and methods for grinding drills with concave configurations, elongated cutting edges, helical point clearances, and others.

All attempts to improve cutting conditions weaken the drill point, according to Troester. Everything considered, he feels that the cone shaped twist drill is best. It meets shop requirements for many jobs, it is of rigid design and it is easily ground.

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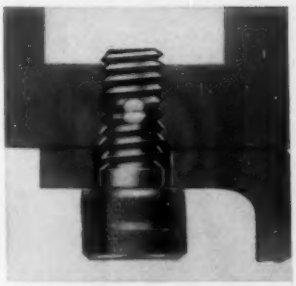

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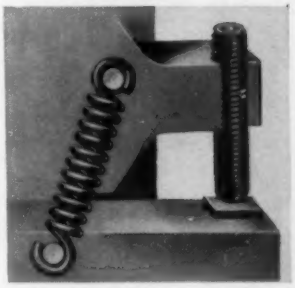

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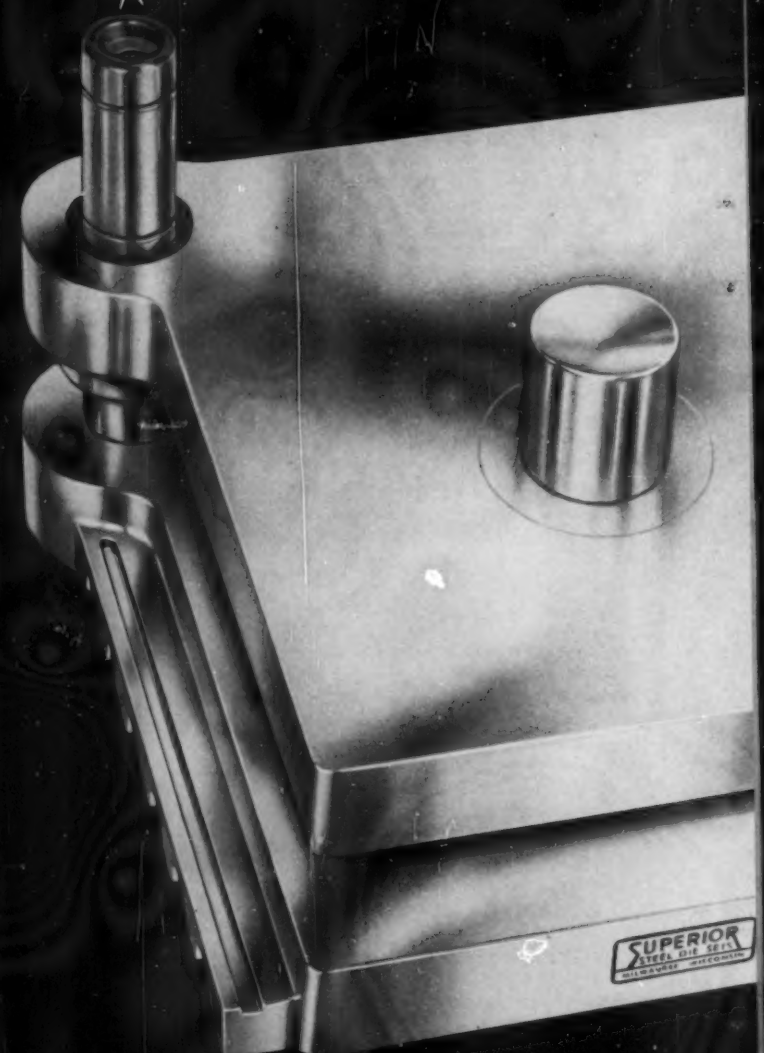

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Tech Digests

Operations Research

The most important application of scientific methods to problems of managerial decision making during the past decade has been operations research. It started as an independent field and those promoting it generally want to keep it that way.

In the book, *Introduction to Operations Research*, (Churchman, Ackoff. Arnoff, published by John Wiley & Sons, Inc., New York, N. Y.) the authors point out that, "Operations research in the most general sense can be characterized as the application of scientific methods, techniques and tools to problems involving the operations of systems so as to provide those in control of the operations with optimum solutions of the problems." This very broad definition by the authors of a highly regarded reference work includes both managerial and nonmanagerial applications. The emphasis is on two concepts, namely, the scientific method and the optimum solution. The implication is to realize them through the use of mathematical techniques which dominate the field in accordance with the background and preferences of its leaders.

The concept of optimization ties in with some of these mathematical techniques. Possibly, it will be considered the most significant contribution of operations research to managerial decision making. Another frequently mentioned concept is that of a team approach. Operations-research workers prefer to operate as a team consisting of experts with different backgrounds, all of whom, however, are devoted to the language of mathematics as a common means of communication.

Operations research in its business applications has been concerned with the design of mathematical models and their manipulation toward an optimum solution of the problems under review. This approach has had a strong appeal for business executives striving toward maximization of profits.

The introduction of the concepts of scientific research to the analysis of management problems has been beneficial in many ways. It has brought to the decision making processes of business executives a background of detailed and meticulous investigation never used before. This, in turn, has had a valuable effect on the over-all analytical techniques of business.

Another significant result has been the discovery that many business problems which appear to be widely different can be reduced to a comparatively small number of basic models. This, undoubtedly, represents an important step toward the determination of fundamental relationships and classifications which are essential prerequisites for the development of a science of management. Continuing work in this area should make very significant contributions to the problems of managerial decision making. However, as might be expected, considerable difficulties developed from the invasion of business by operations-research workers and their peculiar approach to the solution of business problems.

First of all, there has been a lack of mutual understanding between the mathematically oriented operations-research workers and the more pragmatic business executives. The former have no doubts about their ability to optimize business problems provided they can be exactly defined and all the required data can be made available to them. They are easily baffled by the apparent inaccuracy and indefiniteness of businessmen's concepts which are the unavoidable results of the uncertainties and frequent changes facing business at all times. In addition, adequate quantitative data to be fitted into the algebraic formulas developed by operations-research techniques are often not available; this can present a major stumbling block for their use toward solution of business problems. Many managerial considerations do not lend themselves to a determination in exact quantitative terms. A manager will be unable to use the solutions supplied by an operations-research team if he cannot substitute numerical data for the algebraic functions of the operations-research formula. The whole effort will appear to him unrealistic and lacking in practical significance. More general application of operations-research techniques will require a substantial change and expansion of the procedures for developing those numerical data from accounting or statistical systems. Little has been done in that direction up to now.

From a paper "Management Science," by E. H. Weinwurm, Professor, De Paul University, Chicago, Ill., presented at the Winter Annual Meeting of the American Society of Mechanical Engineers, 1960.

Applying Diamond Coatings

Many improved techniques for applying plated coatings to metallic parts have been developed in the last few years. Concurrently, it has been found possible to deposit plated coatings which contain abrasive particles, generally in the micron size range, uniformly distributed throughout extremely thin coatings. Most of the work has been done with the abrasive occupying from 20 to 25 percent of the volume of the coating, generally with nickel as the matrix. These coatings are remarkably uniform in thickness and because the thickness can be controlled closely—to levels in the range of 0.0005 to 0.0010 inch thick—a few diamonds go a long way in coating an appreciable area. The diamond cost per square inch approxi-

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As a result of the development of these techniques, some extremely interesting results have been achieved in manufacturing textile guides for handling nylon fibers and special-purpose knives. Diamond coated plug gages, in service for a year in routine inspection of holes, show excellent wear resistance. It would appear that diamond coated gages for a wide variety of applications will become standard in the future.

Honing as a production operation is becoming of increasing importance and in many honing operations the rates of wear of conventional hones poses a problem in keeping equipment in operation. Diamonds are being investigated for use in those applications where a slower rate of wear would result in increased productivity. In many cases the applications are large multi-spindle machines. Diamonds have already proved their ability to provide increased production in these machines.

From a paper "New Applications for Diamond," by Norman A. Matthews, General Electric Co., Detroit, Mich., presented at the 16th Annual Convention of the Industrial Diamond Association of America.

Fiber-Glass Compressor Housing

The compressor of aviation gas turbines is used to compress air and introduce it into the burners of the engine. To determine the feasibility of using reinforced plastics in the compressor housings, the 4-point program was decided upon. The program consisted of (1) materials development, (2) mold design, (3) fabrication of reinforced plastic compressor housing, and (4) engine tests on the housings.

The housing was fabricated using a composite structural cross reinforcement and glass mat reinforcement. The strength was more than enough. No exact cost estimates were made, but it is expected that similar plastic housings could be produced for less than half the cost of similar magnesium housings. Engine tests indicate that plastic housings perform as well as or better than conventional metal housings. An advantage of the plastic is that clearance between the moving blade tip and the molded housing remains smaller than metal housings. This is due to the lower thermal expansion of plastic, which prevents excessive clearances in the housing with the result that better air pressures can be maintained.

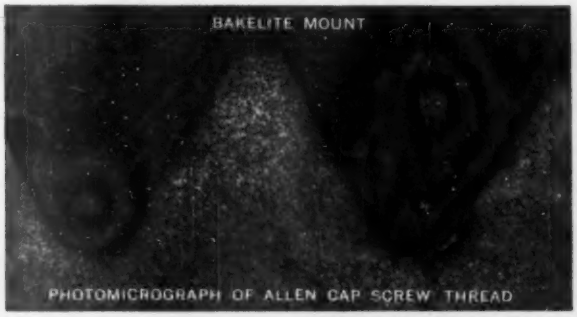
From a paper "Glass-Reinforced Plastic Aviation Gas Turbine Compressor Housing," by C. H. Vondracek and R. N. Sampson, Westinghouse Electric Corp., 3 Gateway Center, Pittsburgh 30, Pa., presented at the 17th Annual Technical Conference, sponsored by the Society of Plastics Engineers, Inc., 65 Prospect St., Stamford, Conn.

PQA* proves it

This Allen screw passes multi-million-cycle test under high load conditions

50X Magnification—unretouched

Here you see a competitive socket-head cap screw where thread laps and deep decarburization (lighter area running through roots of threads) caused premature failure of the screw. When used under high load conditions in an outboard crankshaft-connecting rod-piston assembly, such a screw failure would cause great motor damage.



50X Magnification—unretouched

Now look at this Allen Socket Cap Screw. Photo was taken during regular quality control test and shows no thread lap or decarburization. Allen is producing to and inspecting in accordance with MIL-B-7838A for thread discontinuities—your assurance of quality!

*PRODUCT QUALITY ASSURANCE

PQA is the symbol of unquestioned quality at Allen. It stands for *constant* quality control from rigid upgrading of incoming raw materials to shipment of finished products—*plus* an unconditional guarantee that backs up every order!

Quality checks like the one illustrated confirm PQA every step of the way through Allen's manufacturing process. Remember . . . it costs no more to have *genuine* Allens right from stock, and they are only a minor fraction of your assembly costs.

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MILLING

THROW-AWAYS or BRAZED?

Wesson can help make it easier to decide . . .

MILLING

Compare these two jobs. One called for a Wesson Rigidcut. The other for a Wesson throw-away insert cutter. Why? Finish milling cylinder block top and faces (left) called for 9 in. cutters at 80 ipm. feed and 400 fpm. cutting speed. That's almost ½ in. feed per revolution and calls for all the blades you can get to keep down chip load. This Wesson Rigidcut mill uses 38 blades . . . better than 4 per inch of diameter. You couldn't do that with a T-A cutter or almost any other cutter.

For the crankshaft job (above) Wesson recommended T-A cutters. While production was satisfactory with another type, grinding costs and downtime were high. The switch to T-A's dropped tool costs from over $10,500 to less than $4,400 for the same output per year. Less downtime was a 'plus'.

You can now quickly adjust throw-away insert and other types of boring tools to tenths of a thousandth (in a range of up to ¼") using a vernier scale on the boring bar. Available in standard and special boring tools. Ask for Bulletin #B-1259.

WHICH FOR MILLING . . .

Wesson makes milling cutters—with both throw-away and brazed inserts. Your Wesson field engineer is a "pro".

Ask him to study your high-tool-cost operations and tell you which cutter type he recommends . . . and why. Wesson tools are guaranteed to perform as specified.

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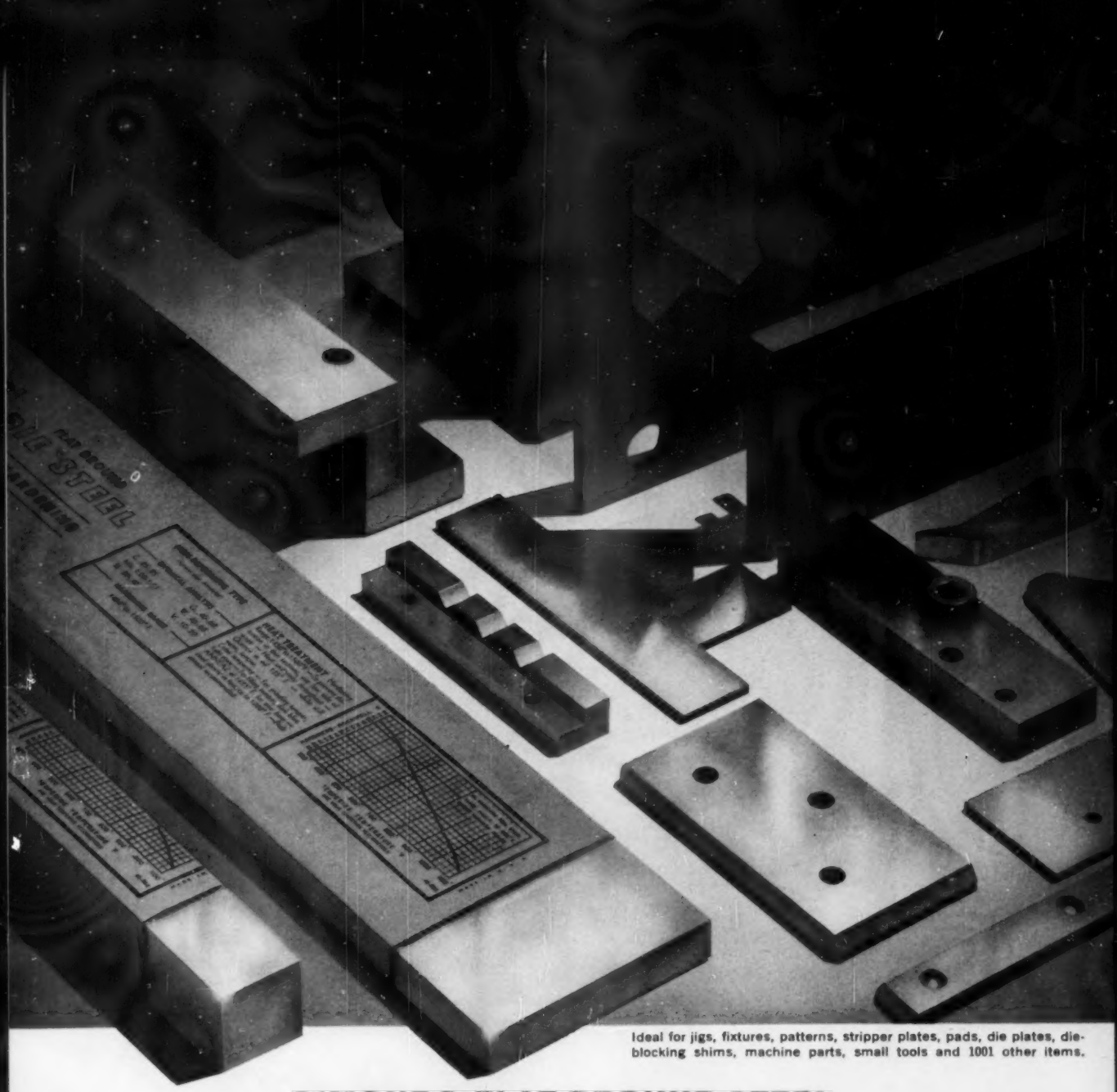

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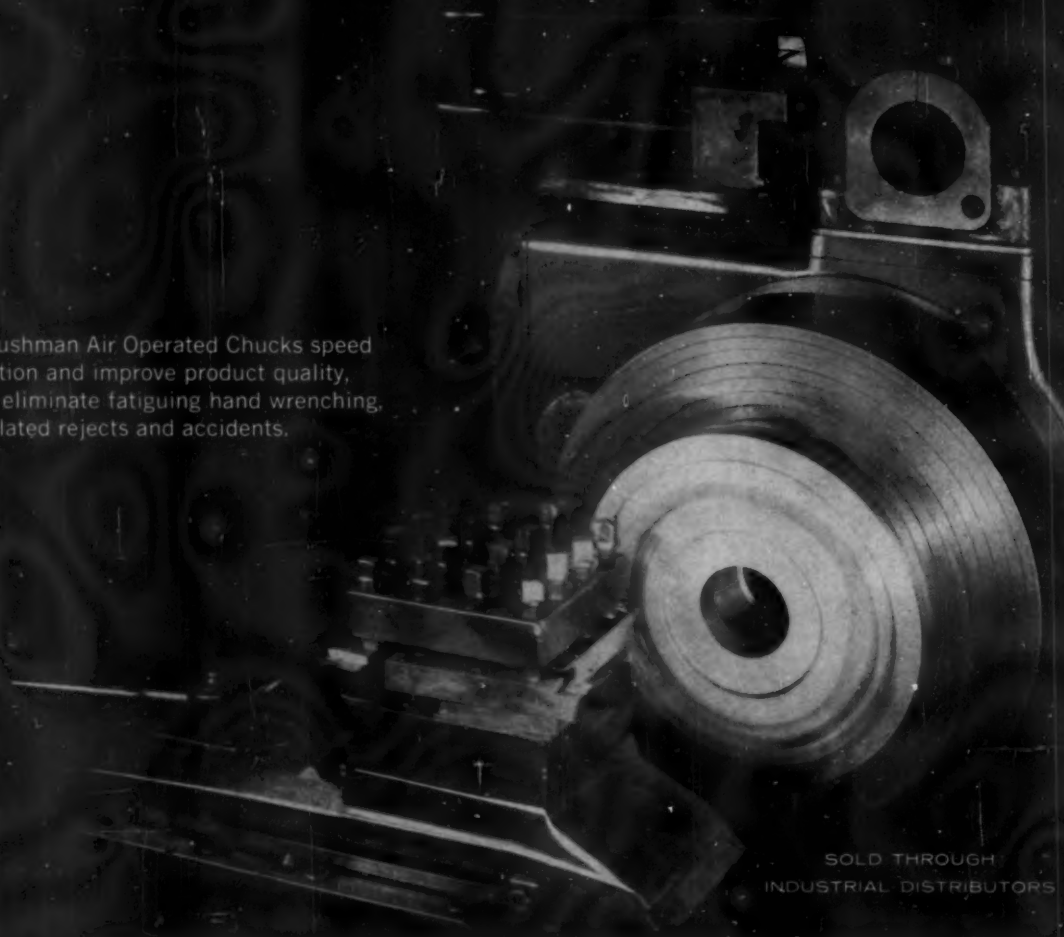

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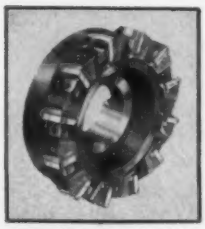


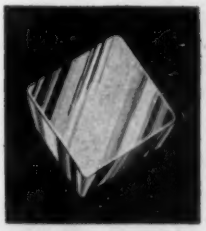
Negative rake indexable insert milling cutters

Clamp-type throwaway-insert tool holders

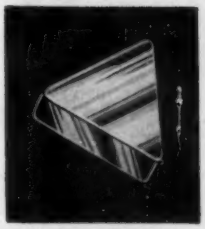
Staggered tooth inserted blade HSS milling cutters

Positive rake indexable insert milling cutters

Throwaway-insert boring bars



Half side inserted blade milling cutters



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new model 3A offers unusual screen brightness and image resolution – features zoom-condenser system

The unusual image brightness, definition and accuracy achieved in the new model 3A—to the very edge of the screen—is a credit to the quality and design of its optical system.

The new Nikon model 3A permits surface as well as contour inspection—independently or simultaneously. And controls are provided for adjusting the intensity of each of the illuminators.

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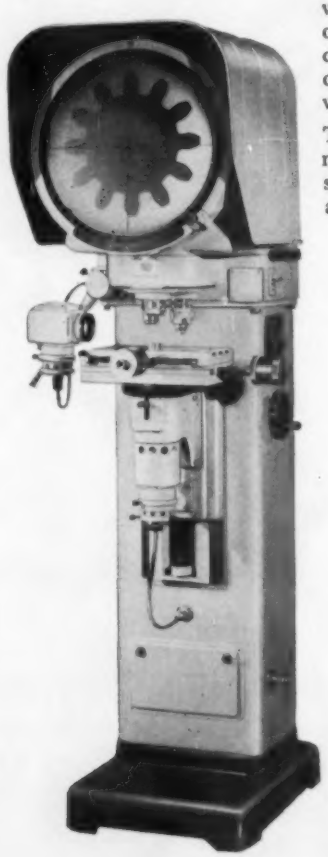
features new 14" screen



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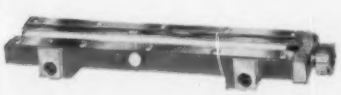

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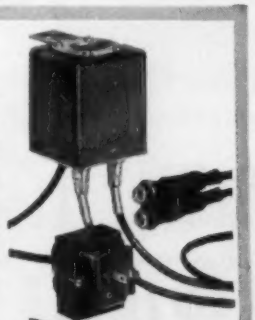

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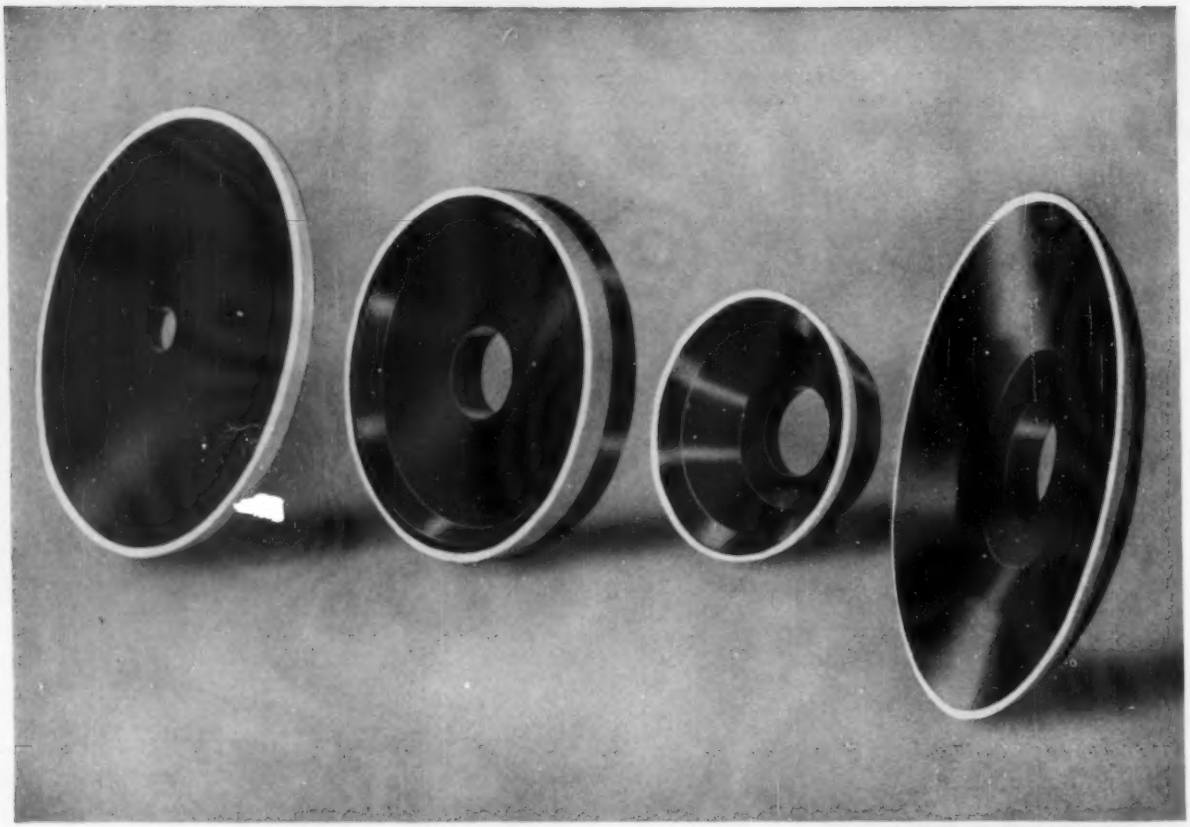

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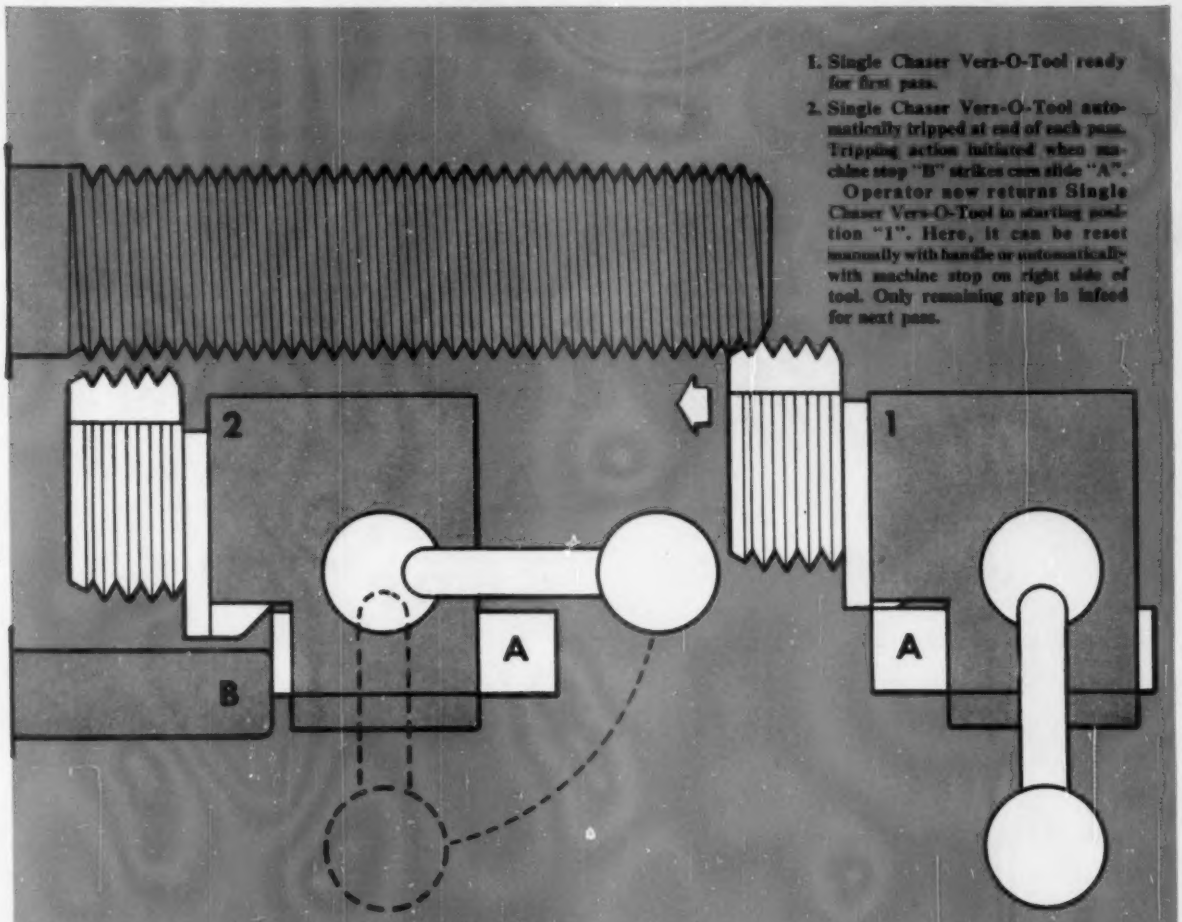
RAYBESTOS-MANHATTAN, INC.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2
1
A
A
B

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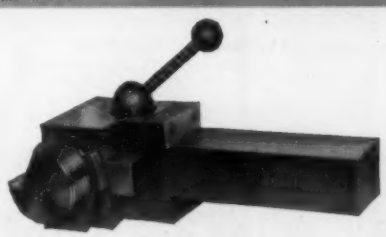

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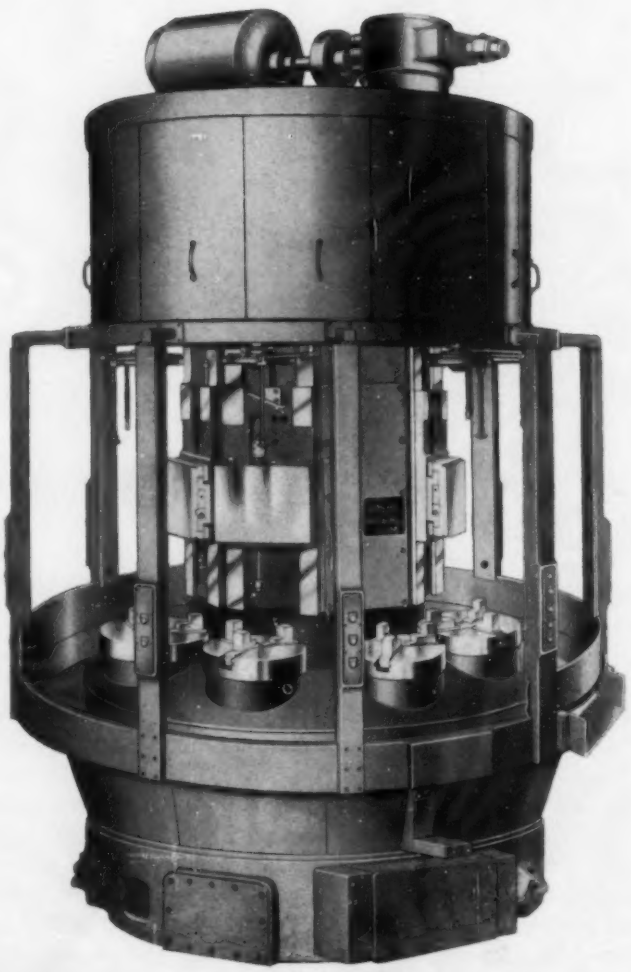

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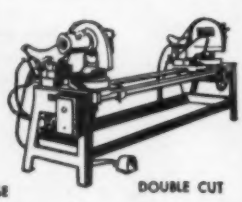
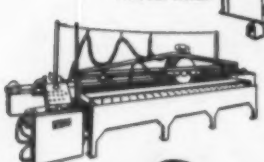


DOUBLE CUT



TRAVERSE

Stone MACHINERY CO. INC.

31 FAYETTE ST., MANLIUS, N. Y.

HIGH SPEED CUTTING MACHINERY

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ANNOUNCING

THE HOLOMATIC COMPACT

SIZE "J"

AIR AND HYDRAULIC POWERED FEED UNITS

- Built-In Versatility
- Amazing Power to Size Ratio
- Quick Speed Change Drive
- Adjustable Rapid Travel Distance
- Adjustable Stroke Length
- Adjustable Feed Rate
- Wide Work Range (1/64 to 3/8" drill and No. 0 to 7/16" tap in mild steel)

3 Models . . . 3 Power-Feed Styles

The new Holomatic family of "compacts" . . . the Size "J", are self-contained, reciprocating quill type power-feed units for use on production drilling, reaming, facing, tapping, threading operations. Used individually or in groups with manual or automatic cycling. Available in 3 "compact" models with 3 power-feed styles with built-in cycle and movement control systems to meet every conceivable need more efficiently and economically.

Write Today . . . **for in-plant demonstration . . . or additional information, specifications and low, low prices on the new series "J" units.**

Hause MACHINES, INC.

MONTPELIER, OHIO

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For torqueing problems USE the

New "TITANTORKER" controlled TORQUE DRIVER

"TITANTORKER" makes controlled power torque available for a variety of torque uses—at low cost.

When desired torque is reached an audible signal is given as the internal driving balls are forced out of their sockets and overrun.

EASY ADJUSTMENT—For increased or decreased torque, "TITANTORKER" can be simply adjusted with an Allen wrench.

"TITANTORKER" can be used with any motive power except impact wrenches. Is ideal for most controlled power torque problems due to ease of adjustment and maintenance.

Available in 4 sizes in maximum torques from 75" lb. to 225' lb., with Female Adapters in driving head and Male Adapters on torque base.

Write for details and prices

TITAN TOOLS — World's Largest Producers Of Stud Drivers And Pullers

TITAN TOOL CO.

44 MAIN ST., FAIRVIEW (ERIE COUNTY), PA.

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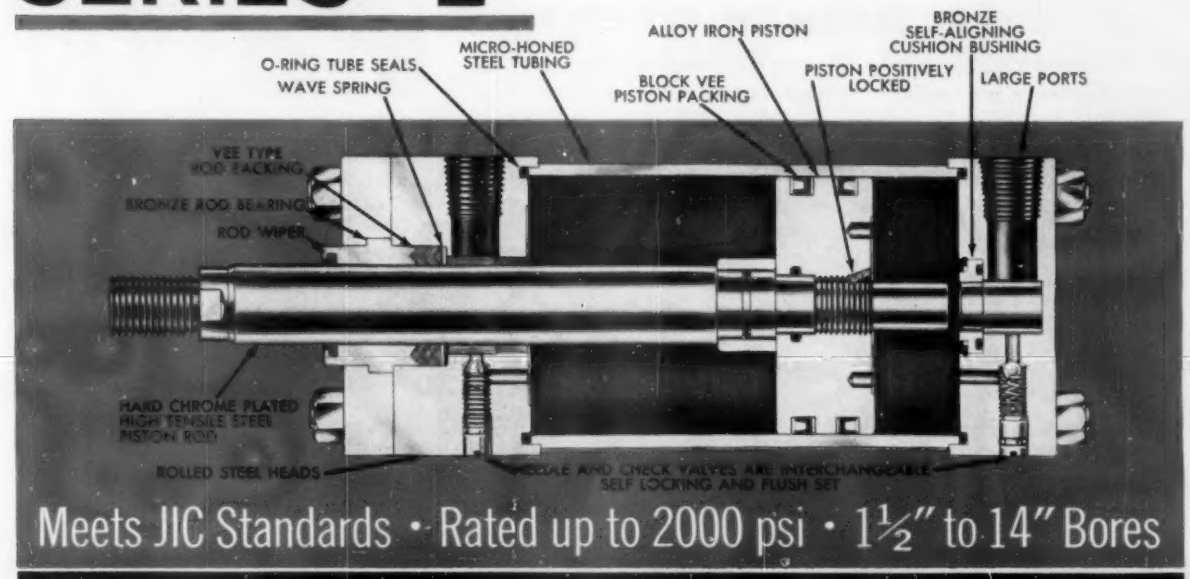
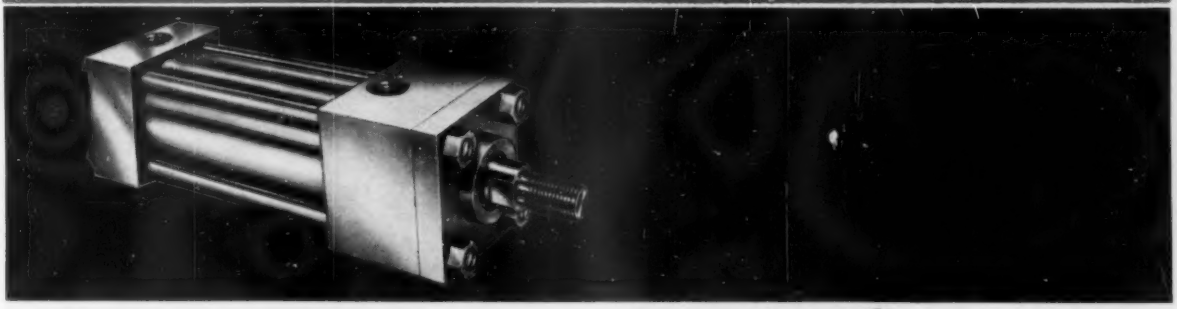
NEW O-M SQUARE HEAD HYDRAULIC CYLINDER

now available

SERIES "L"



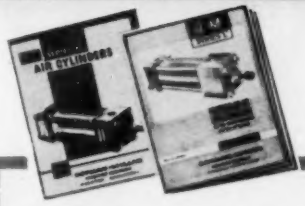
Meets JIC Standards • Rated up to 2000 psi • 1½" to 14" Bores



For years, you have looked to Ortman-Miller for the original space-saving, tie-rodless air and hydraulic cylinders. Now, with the introduction of the new Series "K" air cylinder, recently announced, and the new Series "L", hydraulic cylinder, featured above, you can look to O-M for all of your cylinder requirements.

A product of the teamwork of O-M specialists, this new Series "L" hydraulic unit reflects the research, design, engineering and production capabilities and experience that are an integral part of every O-M cylinder. The result, a quality, hydraulic cylinder designed for long service, high operational efficiency and quick, easy maintenance, dimensionally interchangeable with most cylinders of a like type.

For complete details mail coupon today for Bulletin No. 116 in which all cylinders have been dimensioned in accordance with NFPA recommendations for your convenience.



ORTMAN-MILLER MACHINE COMPANY
13 143rd Street, Hammond, Indiana

☐ Have representative call
Send Bulletins
☐ 115 Series "K" ☐ 116 Series "L"

NAME_____ POSITION_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE____ STATE_____

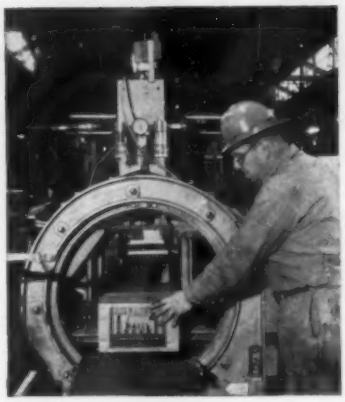
Pullmore Clutches offer

VERSATILE OPERATION

Use any actuation device — air, manual or electric. Rockford Pullmore Clutches start, stop, shift, reverse, inch, cycle and idle. They're used as main drives, auxiliary controls, and power take-offs for thousands of industrial machines. The Dual-Drive Clutches drive forward and reverse, attain high and low speeds, or control as clutch-brake combinations.

. . . FLEXIBLE DESIGN

High-torque compact design fits severe space limitations. Pullmore Clutches are available in single-drive or dual-drive units. The fast but smooth engaging clutches handle torque loads from 126 to 11,000 inch pounds . . . horsepower from 1 to 90 at 500 RPM. Sizes range from 1¾" to 8½" in diameter. Oil or dry operation. Write today for illustrated brochure.

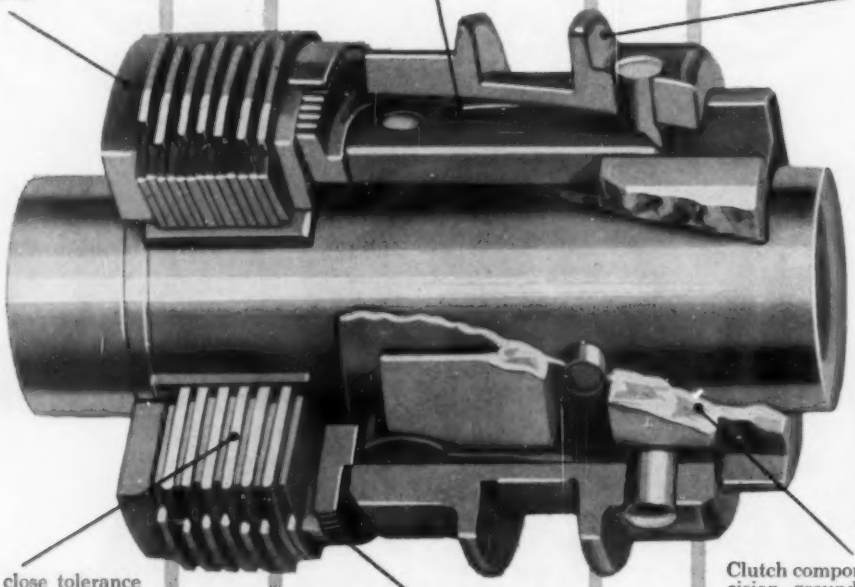


United States Steel Supply Model 12 Automatic Strapping Machine equipped with Rockford Dual-Drive Pullmore Clutch

Symmetrical design and precision machining assure smooth clutch operation. Torque is not affected by centrifugal force or direction of rotation.

Low axial pressure to levers gives positive, instantaneous engagement. High-ratio levers are case hardened forged steel. Immediate disengagement.

Use any actuation device — air, manual or electric. Slight pressure to shifting spool engages clutch. Spool length prevents binding and gives longer life.



Discs meet close tolerance flatness checks. Heat treated steel, graphite-impregnated bronze, sintered bronze or molded discs for oil and dry operation.

Easy Adjustment . . . simply raise locking spring and turn collar. Adjustment lasts for extra-long periods of heavy-duty service.

Clutch components are precision ground and highly concentric. Locking split ring assures positive axial positioning. Strong construction gives long, rugged clutch service.

ROCKFORD CLUTCH

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ROCKFORD B-W CLUTCH DIVISION OF BORG-WARNER

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* CARBIDE DIES
* STEEL DIES

BEFORE YOU RE-TOOL, we strongly urge you to make use of our Customer Consulting Service for recommendations as to what type of die would be best for your application. A typical example is the way more and more manufacturers are turning to Harig Carbide Dies because of the tremendous cost-saving advantages resulting from less downtime—longer runs—lower maintenance.

Harig's many years of experience and know-how in engineering and building dies is at your service—from the simplest to the most complicated designs, of carbide or steel. Phone or write us today and a Harig engineer will be happy to call at your plant, at your convenience.

NEW HARIG BROCHURE

...loaded with information on Harig carbide and steel dies, photos of plant facilities, charts, etc.

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Products by Harig Machine Tool Division

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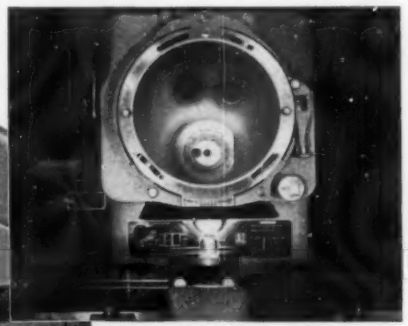
PRECISION MEASUREMENT FOR LARGE, HEAVY WORK AS WELL AS TINY PARTS*

Here is another brand new Jones & Lamson Optical Comparator and Measuring Machine. Its unique feature is a work table supported on *two* heavy duty columns having 10 pitch hardened and ground lead screws, allowing fast, high precision measurements.

The new J&L FC-14ER provides a 10″ lateral, 8″ vertical measuring range. Spacious table top has two fixture slots and is 32″ by 8″. Roller bearings provide smooth, fast, accurate traverse. Lamphouse on this large capacity comparator is adjustable for maximum throat clearance from 16″ to 18″ without obstruction to operator.

This new quality control tool has all the advanced design features of J&L Comparators. For example: J&L Telecentric Optical System requires no adjustments when changing magnifications. Electronic variable speed adjustment provides fingertip control for slow and fast positioning motions. And optional features such as the Normal Reflection Unit extend versatility even further. Get complete details. Write for Folder GL-6111.



Normal Reflection Unit provides maximum brightness, regardless of surface finish of part being inspected . . . even at high magnifications.

*** Small Items Too**

Sometimes it is hard to make the best even better . . . but it is done here.

Although you can inspect the tiniest and lightest parts, with utmost precision, on this comparator — you can also handle the brute jobs to the same degree of accuracy. Extra capacity and rigidity make the awkwardly long, or quite heavy, objects easy to handle.

MODEL FC-14ER

J&L

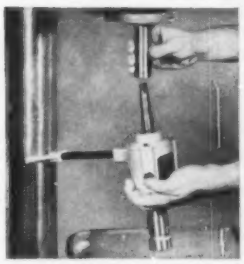
JONES & LAMSON MACHINE COMPANY

518 Clinton Street, Springfield, Vermont

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

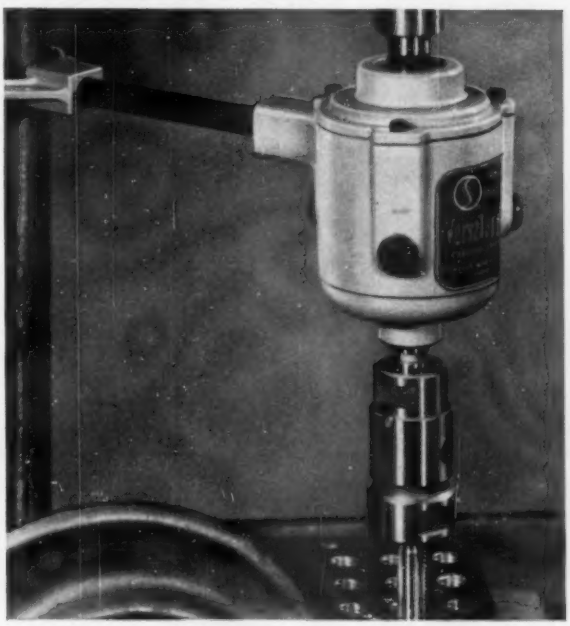
IT'S A FACT!

You can tap 1/2" holes with a light drill press and Supreme's New VersaTAPPER



Shaft of Model 6100 is held in drill press chuck. No. 6200 (above) has Tapered spindle.

Supreme Accutap Chuck is standard equipment with VersaTAPPER. Capacity 0-½"



VersaTAPPER is a compact precision-made tapping unit. Fits any drill press . . . features half-inch capacity range plus 4-time increase in torque. Easy to install. Simple and quick to remove after use.

VersaTAPPER...
operates easily in any material
. . . with widest capacity range
. . . yet costs far less

JUST $63 COMPLETE

The *new* VersaTAPPER has scored an instant success with production people everywhere. It has more versatility than other tapping devices. It has the *widest capacity range*—from 0 to ½", but depending on application, use of taps smaller than No. 10 is limited. It develops *more power*—makes the tapping of ½"-13 holes a simpler matter, even with light duty drill presses. VersaTAPPER is *simple to use*—can be successfully operated by anyone in your shop.

All of these features at the remarkably low price of $63.00 complete marks VersaTAPPER as a product you must see at the first opportunity. It's available at your local Supreme Chuck distributor. Call him soon.

Supreme
PRODUCTS CORPORATION
2222 S. CALUMET AVENUE • CHICAGO 16, ILLINOIS

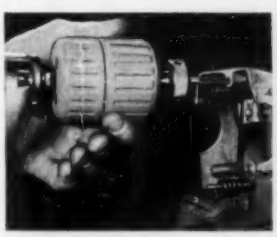
You get more from power tools with Top Quality Supreme Accessories

Supreme Brand Chucks

Noted for unmatched quality. The widest range of sizes and types...one for every machine in your shop. Exclusive Supreme hardening means greater accuracy—longer wear.

Supreme Versamatic

Reversible speed reducer for portable drills. Fits all makes —permits their use for power screw driving, nut running and heavy duty drilling. 7 to 1 reduction means high torque increase. *A fine tool.*



Supreme Push-Pull Tapper

Like the Versamatic, but made for the single purpose of tapping with portable drills. Reverses instantly for tap removal. Handles taps up to 5/16" diameter. Top quality. Simple to operate.

SUPREME PRODUCTS ARE IN STOCK IN YOUR CITY. CALL YOUR DISTRIBUTOR

PRECISION ASR PRODUCTS

TYPE LO—OPEN GUIDE POST

Double post rack and pinion separated to allow parts to project between posts • Light weight for easy shifts from operation to operation • Shown with Full Tray Head and Ball Weight Handle —numerous other styles available.

OVER 70 SIZES AND STYLES

TYPE L—FOR RIGID OFF SIDE CLAMPING—Three post design and totally enclosed base insures ample rigidity for all manufacturing needs • Full Tray Head and Plain Wrench Handle illustrated is only one of many combinations available.

TYPE LS—FOR SPRING CLAMPING

Provides automatic chucking and is constructed with a follow-up head • Piece cannot loosen during machine operation • Head styles to meet your needs—Full Tray Head and Removable Type Stub Wrench pictured.

TYPES LL AND LH—FOR LIGHT AND HEAVY DUTY CENTER LINE CLAMPING—Handle 2, 3 or 4 small parts per pass or single long awkward shape • Plain or Tray Heads • Double action Lock standard on LH Heavy Duty Fixtures—Lock closed and open.

SWARTZ STANDARD FIXTURE DIVISION

PARMA, MICHIGAN

CUT TOOLING COSTS

with

SWARTZ STANDARD FIXTURES AND FIXTURE LOCKS

FOR QUICK SERVICE, CONTACT THE DISTRIBUTOR NEAR YOU OR WRITE FACTORY DIRECT.

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FAMOUS SWARTZ LOCKS ARE USED IN ALL SWARTZ STANDARD FIXTURES

More than 40 sizes and styles • Single or double acting • Right or left hand • Wide assortment of wrench and handle types • Often used on special tooling.

GENERAL

Reuse Bases and Locks with new Head or retool old Head • Base Surfaces from 2" x 5" to 12" x 36" • Closed heights from 3" to 10"—specials to order • All fixtures manufactured from quality materials with precision Racks and Pinions • 100% final inspection • All Swartz Standard Fixtures available equipped for Automatic Air operation.

ASK DISTRIBUTOR NEAREST YOU (above) OR WRITE FACTORY DIRECT FOR YOUR ENGINEERING CATALOG OF SWARTZ STANDARD FIXTURES AND COMPONENTS

A DIVISION OF

UNIVERSAL VISE & TOOL CO.

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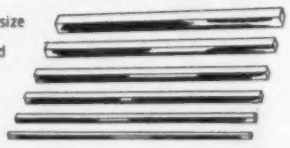
KEEP UNIT-COST DOWN

Specify **MAK-A-KEY**

Pre-Cut, Pre-Coated Steel Key Stock

OVER 60 SIZES STOCKED

- Made .000" to +.003" oversize
- Rustproof • Zinc-Coated
- Just Cut, File, Fit
- Proven in 1001 applications



HANDLED NATIONALLY BY 700 JOBBERS

For all machine tools, presses, process and automation equipment, rely on MAK-A-KEY key stock in 12" and 48" lengths. Available in a variety of sizes for virtually every application. Reduce storage area for key stock inventory, cuts production steps, lowers machine down-time.

MAK-A-PIN Round Steel Bars, too!

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D.J. STEEL

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DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
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for an hours run or day-in day-out production...

IMPORTANT COST REDUCTIONS WITH Standard MSO

900 PER HOUR
TERMINAL
1200 PER HOUR
ELECTRONIC CONNECTOR
Operations Performed: Center drill to C'Sink, drill .0436/.0466 hole, cross mill slot, deburr hole and O.D. Material: Beryllium Copper. Time: 3 seconds—1200 per hour.
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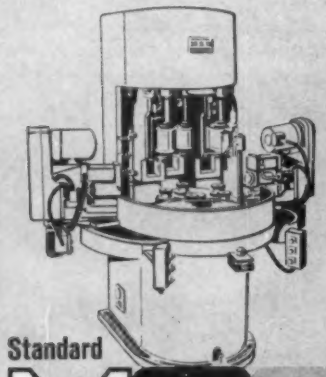
SPECIAL STUD

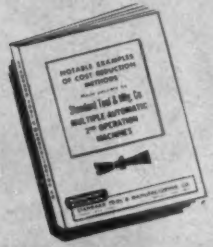
All 2nd operation machining of each of these parts performed simultaneously by a Standard MSO.



Standard MSO

A high speed, versatile machine which performs many multiple, second operations — simultaneously — with great accuracy. Complete details regarding mechanical features and specifications contained in a new booklet available on request. Ask for Booklet, No. 61.

Small Shop or Large Plant cannot afford to be without Standard MSO. The applications are endless—the technique unmatched. For Standard MSO performs up to 5 simultaneous operations at high speed with extreme accuracy—eliminates the need for Hand Screw Machines, Drill Presses, Light Milling Machines, Tapping and Threading Machines and other single purpose machines. Tooling and change-over is quick and simple.



This Illustrated Booklet, No. 35, can help you gain important cost reductions. It contains many detailed, case history drawings. We shall be glad to send you a copy without charge.

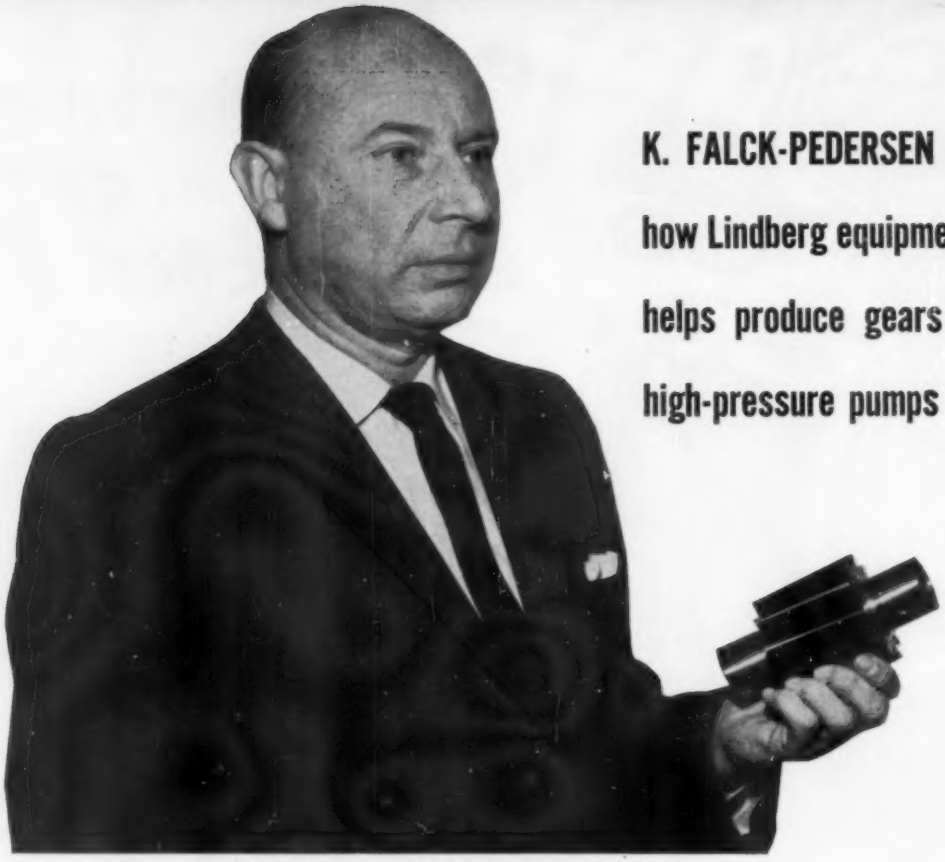
MACHINERY DIVISION

Standard Tool & Manufacturing Co.

714 SCHUYLER AVENUE • LYNDHURST, NEW JERSEY

Better Products at Lower Cost through Better Methods

K. FALCK-PEDERSEN tells how Lindberg equipment helps produce gears for high-pressure pumps



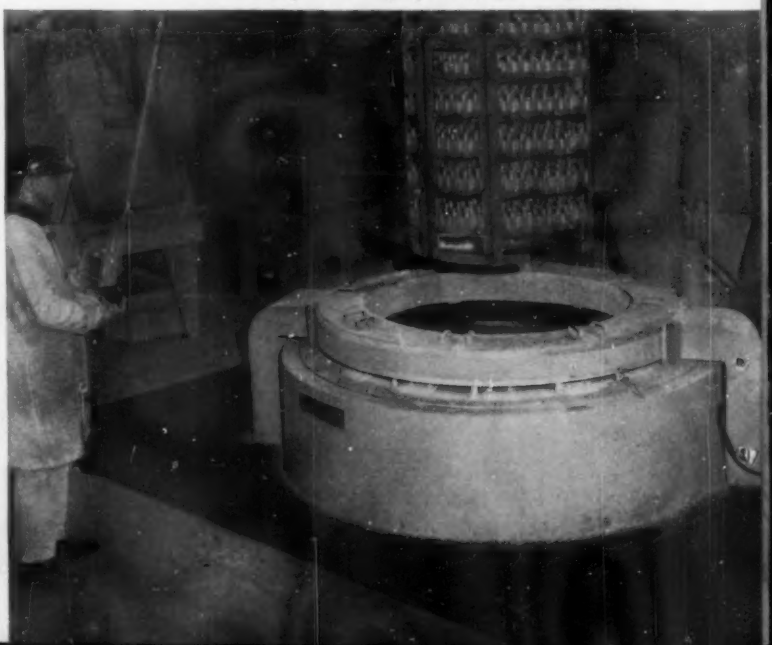
QUOTE

Mr. K. Falck-Pedersen, Chief Engineer, Commercial Shearing and Stamping Company, Youngstown, Ohio.

"The Lindberg heat-treating furnaces and atmosphere generating equipment installed in our Youngstown plant two and one-half years ago provided a fine solution to a big problem of ours. The units now give us complete and precise control over hardening and treating of gears for our high-pressure pumps. During these years, the equipment has proven trouble-free, required little maintenance and has proved to be remarkably easy to operate."

COMMERCIAL shearing & stamping

Gears being loaded in Lindberg Furnace at Commercial Shearing and Stamping Company, Youngstown, Ohio.



Lindberg equipment at Commercial is used for carburizing gears for high-pressure pumps and allows mass production of practically distortion-free gears, while holding the degree of hardness as well as depth of case to very close tolerances—load after load after load. The installation includes one electric and two gas-fired furnaces, Lindberg Hyen Atmosphere Generator and Carbotrol.

If you have a problem in heat treating, why not get the Lindberg representative's help now? You can depend on his experience and Lindberg's engineering and design know-how to provide exactly the right equipment for your need. And it's easy, too! Just call your Lindberg Field Engineer (he's listed in your classified phone book) or write us direct. Lindberg Engineering Company, 2447 West Hubbard Street, Chicago 12, Illinois.

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, Spain, Switzerland and West Germany.

LINDBERG
heat for industry

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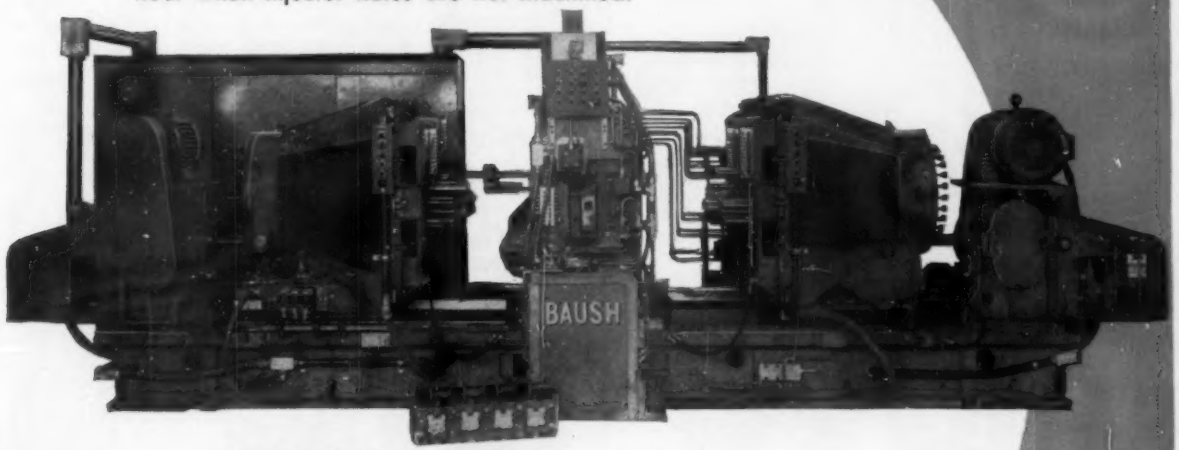
IRREGULAR HYDRAULIC FEED vs SMOOTH, CLEAN MECHANICAL FEED—

is easy to recognize when you watch machines like this BAUSH 2- WAY HORIZONTAL "M-25" MECHANICAL SCREW FEED in operation, because - - -

- **No hydraulic fluid is needed — a real savings**
- **No fluid leaks or feed fluctuations — reduces maintenance**
- **No "break-thru" surge — reduces work spoilage**
- **Positive, smooth ball-screw feed — saves breakage**
- **Part spoilage and tool breakage is reduced to minimum**
- **Your own mechanic can maintain units — reduces cost**

PRODUCTION:

Designed specifically for drilling, counter-boring, reaming and forming valve seats, this machine finishes 12 cylinder heads an hour when machining injector holes, and 18 per hour when injector holes are not machined.

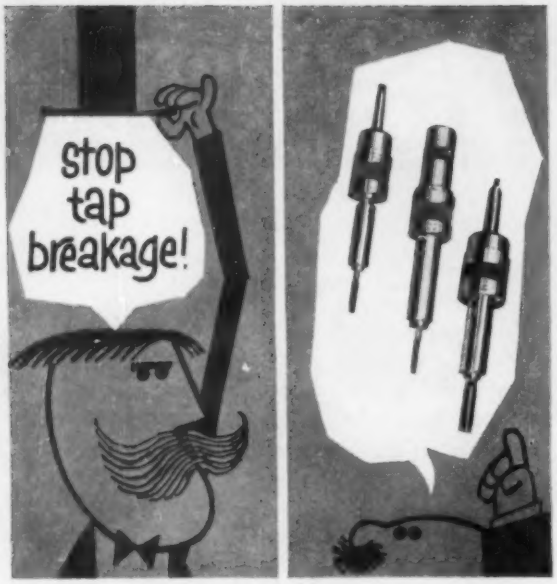


SPECIFICATIONS:

This Baush machine is fully automatic — has two 27" x 50" drilling heads with a total of 76 spindles with each spindle arranged for two speeds and a neutral position. The master-bored cluster plates have slip-sleeve spindles and entire unit has Trabon lubrication throughout.

Fixtures are transfer bar type; fully automatic to accommodate three different size cylinder heads. Base is arranged for chip conveyor disposal and the 5 motors and electrical controls are J.I.C.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS



Scully-Jones "Safe-Torque" drivers release smoothly, instantly, and completely below the break strength of the tap. Let you tap at high speeds to full depth. There's no heat-producing friction or impacting. Preset torque remains constant without readjustment. Increase production . . . reduce scrap . . . upgrade quality. Three types, described in Bulletin No. 20-50. Write for your copy, today.

SCULLY JONES

Scully-Jones and Company

1915 South Rockwell Street, Chicago 8, Illinois

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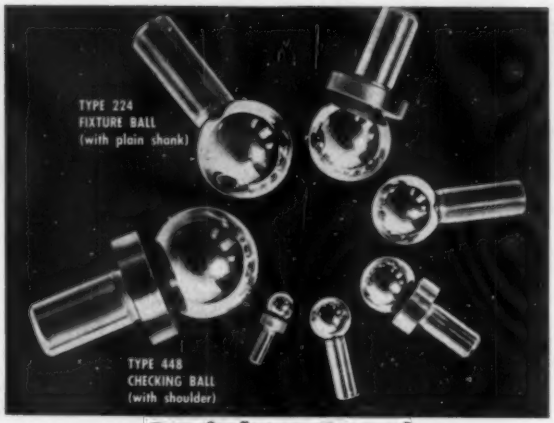

Stainless Steel

TOOLING BALLS

- **Used in** jigs, fixtures and job setups as positive reference points for locating holes and surfaces at compound angles or in two or more planes.
- **Durable.** Made of hardened 440-C stainless steel.
- **Highly accurate.** Ball size is held to ±.0001" for fixture balls; ±.00002" for checking balls.
- **In stock** in 7 ball sizes, ¼" to 1" by ⅛" steps.

WRITE FOR prices and fact-filled BULLETIN B-42.

INDUSTRIAL TECTONICS, INC.

iTi

MANUFACTURERS OF PRECISION BALLS AND BEARINGS

BALL DIVISION: 3686 JACKSON RD.

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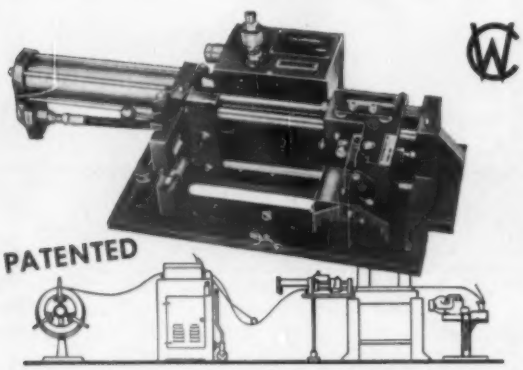

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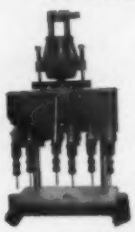

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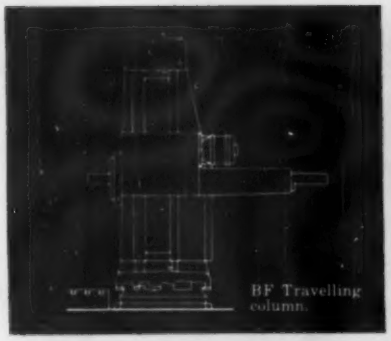
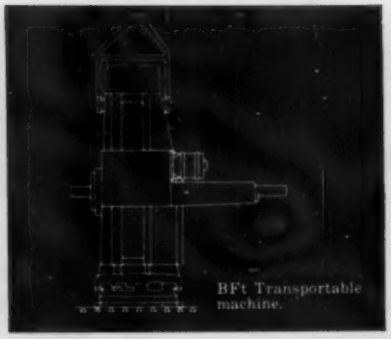
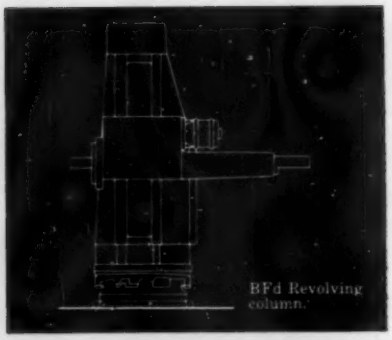
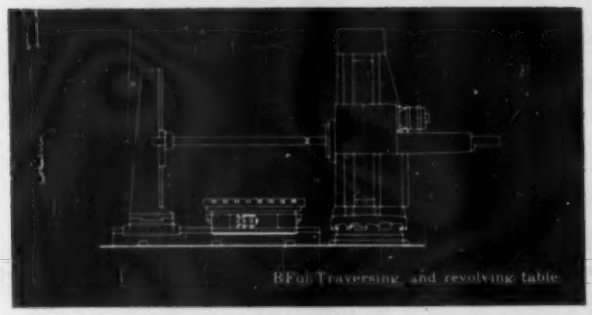
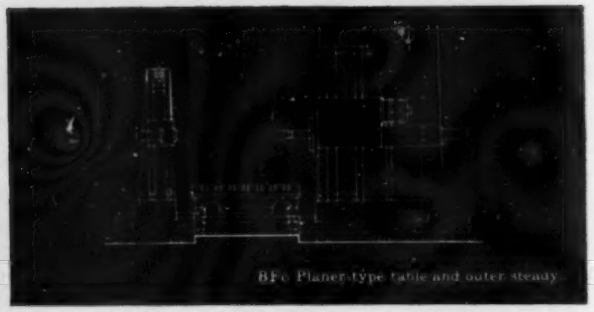
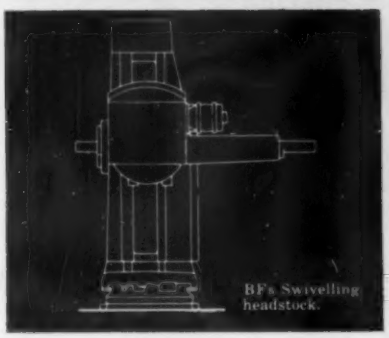

BF Travelling column.

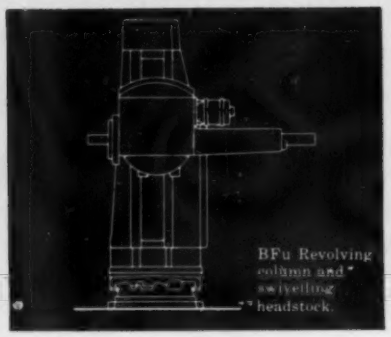

BFt Transportable machine.

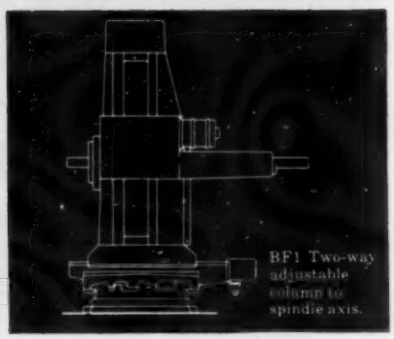

BFd Revolving column.


BFdt Traversing and revolving table.


BFe Planer-type table and outer steady.


BFs Swivelling headstock.


BFu Revolving column and swivelling headstock.


BF1 Two-way adjustable column to spindle axis.

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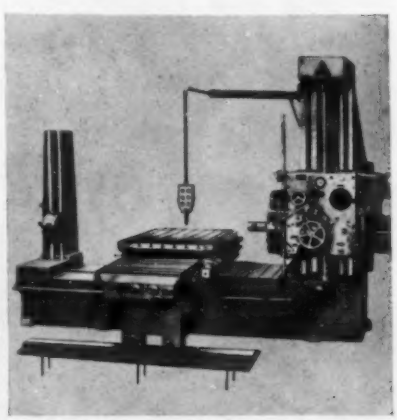

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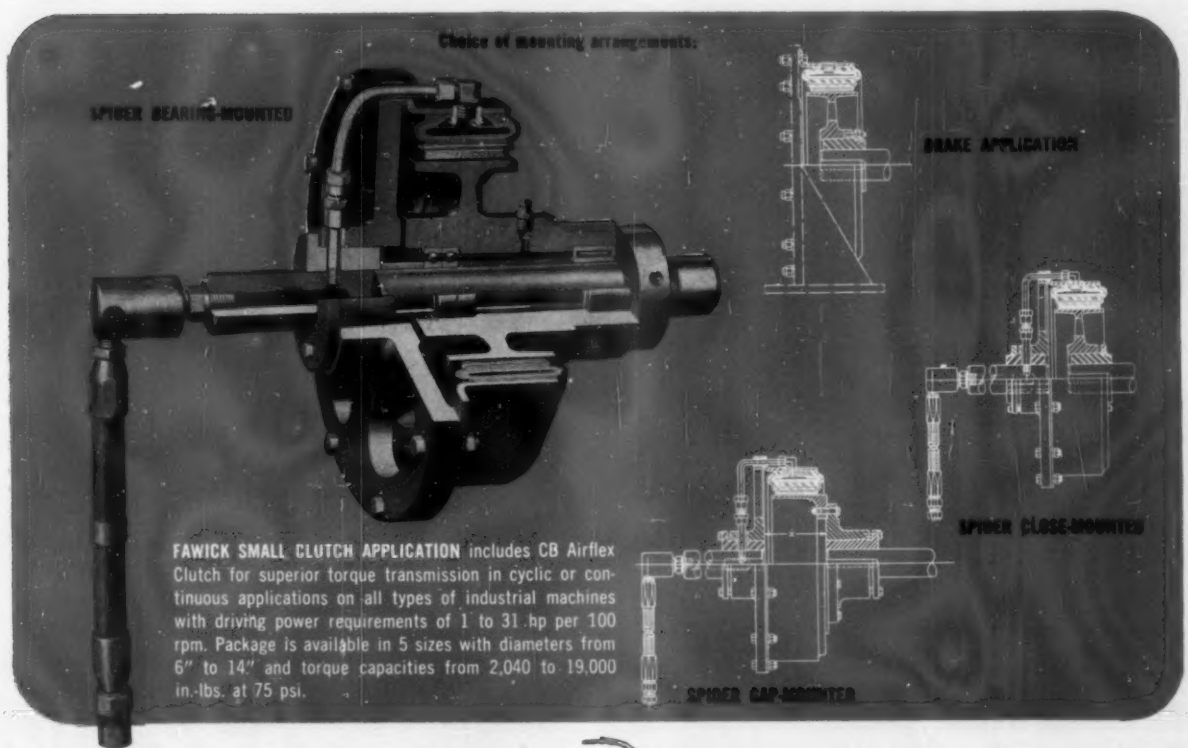

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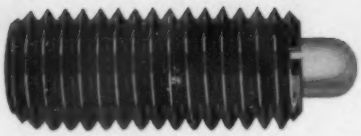

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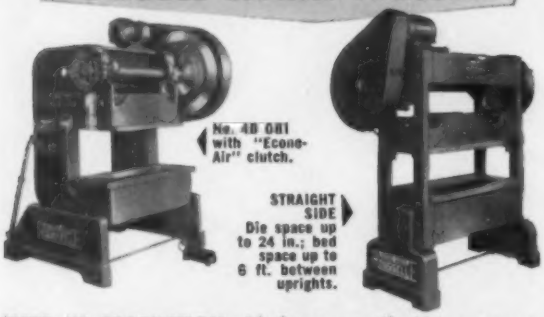
DOUBLE-CRANK PRESSES



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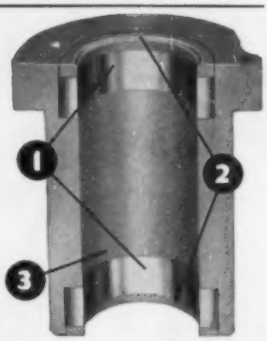

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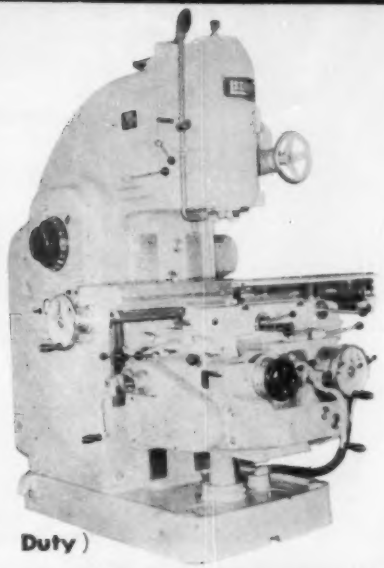

(Medium Duty)

Working Surface (Table)	$53\frac{5}{32}$" x $12\frac{13}{64}$"
Main Spindle Speeds (21 different speeds)	33-2,000 rpm

1) Changing speeds of spindle are controlled by the hydraulic system of the shifting gear. Jump select is easily operated by setting the selector dial. Change of meshing gears is controlled by the synchromesh system so that the gears can mesh safety and thoroughly.
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MODEL 4A UNIVERSAL TURRET LATHE

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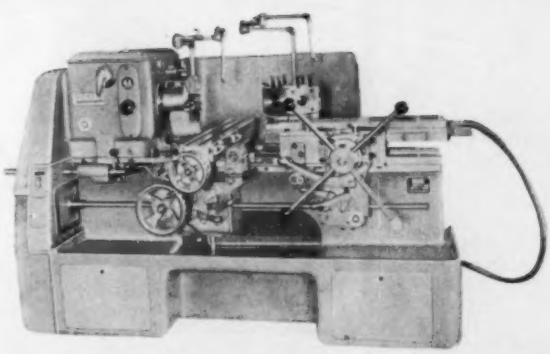
Chuck Capacity (3 Jaw scroll chuck)	10"
Spindle Speeds (16 different speeds)	40-2,000 rpm

It is possible to select easily and speedily 16 different speeds from 40 rpm in minimum to 2000 rpm in maximum with a mono-lever connected to the reversal braking motion of motor.



(Chuck Machine)

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4-POST TABLE WITH DRAWERS

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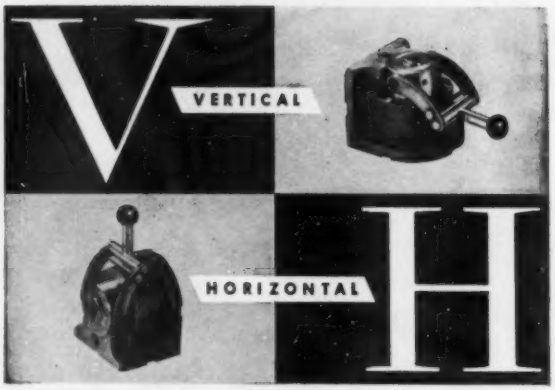

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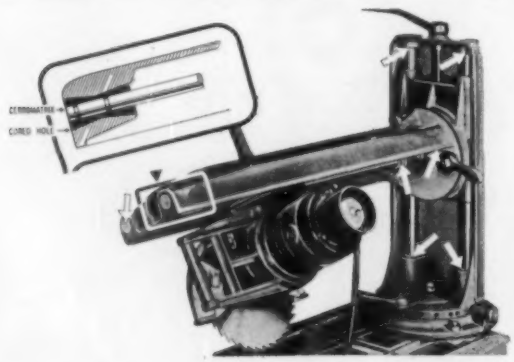

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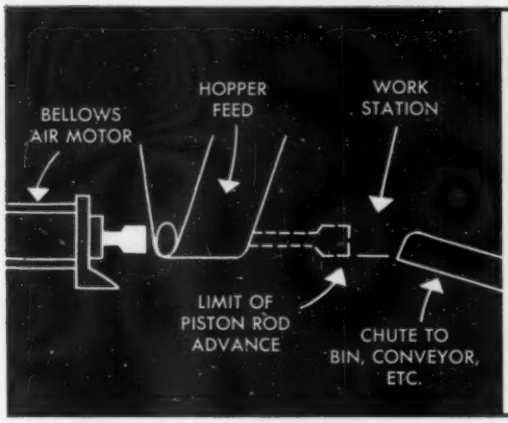
Shown here are three ways you can use Bellows Air Motors® to feed and position workpieces more quickly, efficiently and at lower cost. They are typical of the many ways Bellows Air Motors are used in all types of industries.

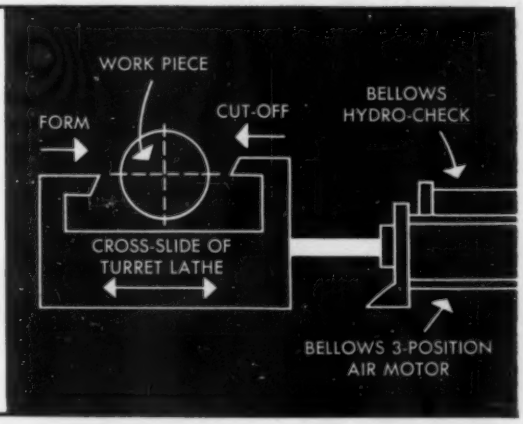


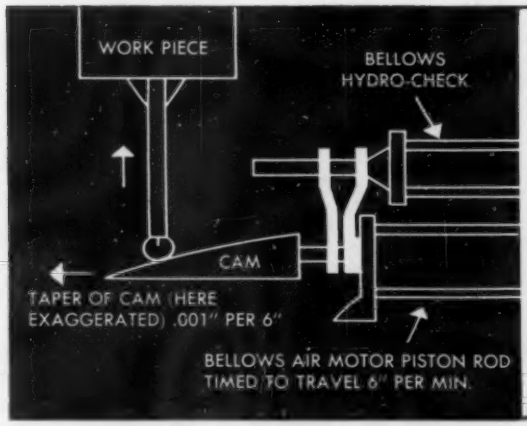
HORIZONTAL, STRAIGHT-LINE POSITIONING AND EJECTING

This extremely simple set-up is widely used in conjunction with hopper feeds in stamping and coining, sawing, drilling, deburring, inspection and similar operations. On its advance stroke, the piston rod of The Bellows Air Motor takes a workpiece from the hopper and moves it until, at full advance, the piece is properly positioned for the operation. The positioning of each workpiece serves to eject the preceding unit. Speed of advance and retract strokes is individually adjustable. The Air Motor can be set for either single cycle or continuous operation, and, when desired, is easily synchronized with a machine element.

FEEDING CROSS-SLIDE OF TURRET LATHE

The sketch at right shows a typical application of a Bellows 3-position Air Motor feeding the cross-slide of a turret lathe. Center, or "neutral," position of Air Motor piston rod is tool "at rest" position. Rod retracts to "form," advances to "cut-off." Using sequencing switches, the Air Motor's operation can be synchronized with the automatic turret to "form" at any point in turret's sequence, return to neutral until all other operations have been performed, then to advance to "cut-off." Speed of advance and retract strokes is independently adjustable. Incorporation of a Bellows Hydro-Check® provides accurate control of piston rod, complete freedom from "chatter."




WORK PIECE
BELLOWS HYDRO-CHECK
CAM
TAPER OF CAM (HERE EXAGGERATED) .001" PER 6"
BELLOWS AIR MOTOR PISTON ROD TIMED TO TRAVEL 6" PER MIN.

SLOW, ACCURATE FEED RATE

Slow and/or highly accurate feed rates--such as might be required by certain grinding and cut-off operations—can be achieved by advancing the work-holding fixture by the action of a roller moving on a tapered cam which is mounted on an Air Motor's piston rod. As shown in the sketch at left, for example, the cam has a taper (greatly exaggerated in the illustration) of .001" per 6" length. If the piston rod is timed to travel 6" per minute, the resulting feed rate of the workpiece is .001" per minute. Compound feed rates can be obtained by appropriate variations in the contour of the cam. Perfect smoothness and accurate control of Air Motor's piston rod is assured by use of a Bellows Hydro-Check.

807-C

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Contains information on a variety of different parts feeders, as well as installation data, wiring diagrams and equipment lists for scores of other "Controlled-Air-Power" applications. Write for your free file . . . today! Address Dept. TE-961, Bellows-Valvair, Akron 9, Ohio.

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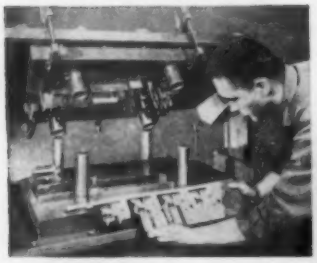

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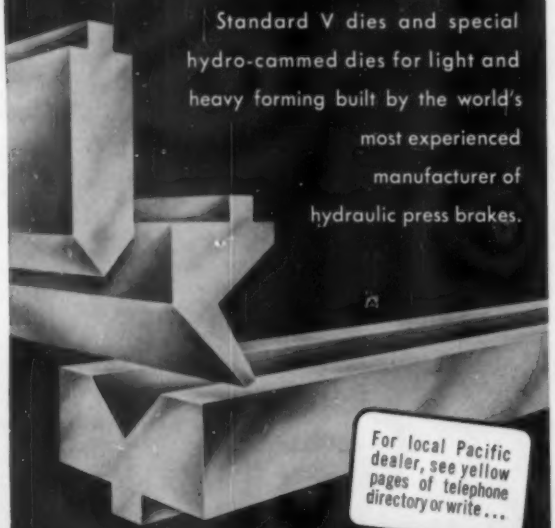

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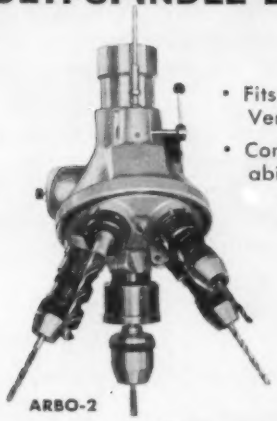

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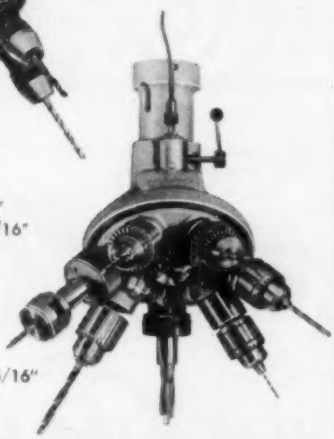

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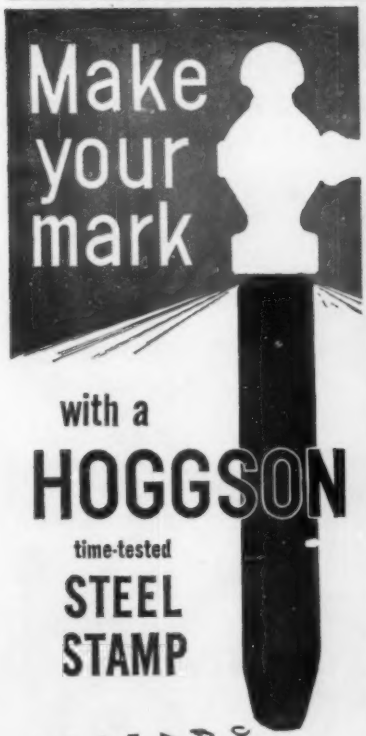

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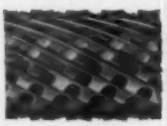

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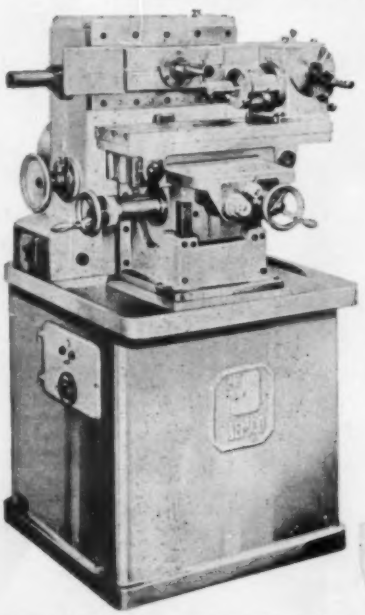

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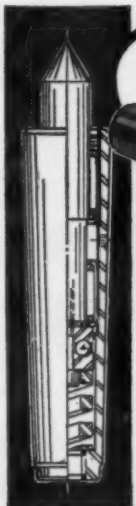

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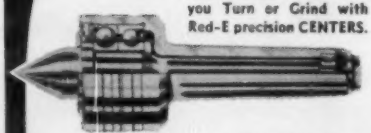

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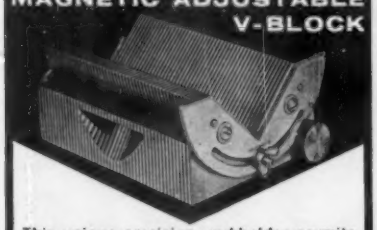

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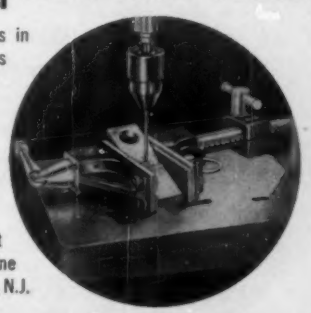

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September 1961

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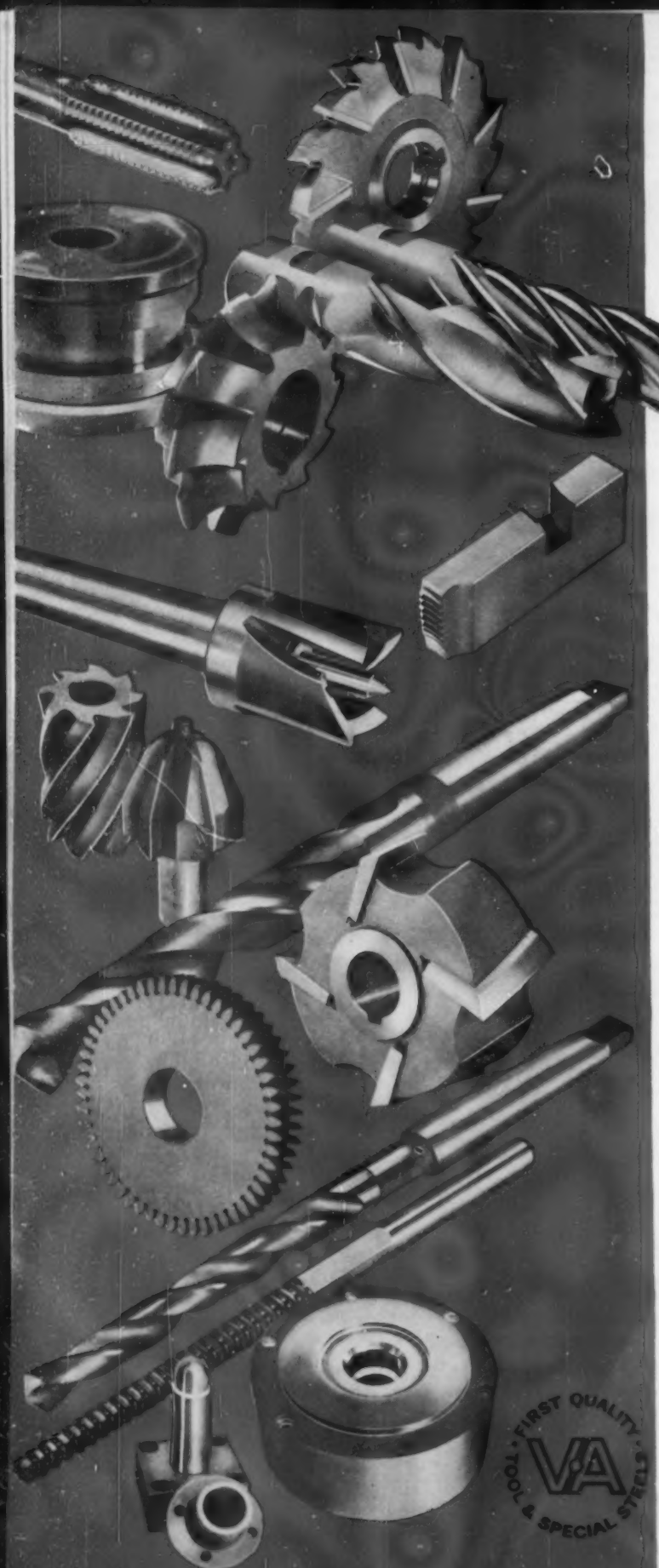

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the *difference* is in your favor!

Among High Speed Steels of identical analysis made by different manufacturers, you'll find a *difference in performance* at the working point. And you'll find the greatest difference when you compare a Vanadium-Alloys brand against the field!

The reasons are fundamental. Our melting techniques are based on many years of the only *specialized* tool steel production experience in the industry. Our methods of forging, rolling and heat treating are exclusively our own—developed to insure the bonus of *extra* performance in every single grade of steel we make.

As tool steel specialists for over fifty years we produce many grades and brands, to but one standard of excellence: FIRST QUALITY, unvarying. We suggest you prove for yourself that *the difference in performance is always in your favor* with Vanadium-Alloys High Speed Steels. Let us consult on your applications.

Nationally popular grades

VASCO SUPREME	VASCO M-7
NEATRO	VAN-LOM
RED CUT COBALT	VASCO M-2
VAN CUT	RED CUT SUPERIOR
E. V. M.	8-N-2

VANADIUM-ALLOYS STEEL COMPANY

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OVERSEAS CAR BUILDER ADDS ANOTHER SNYDER TRANSFER MACHINE IN FURTHER MOVE TO CURTAIL COSTS

Intensified competition for world markets brought back this old friend of Snyder products seeking further relief from manufacturing cost and labor problems. The answer to this specific problem is a Snyder Special 20-station, building block transfer machine that drills, reams, taps, chamfers and precision-bores 78 automotive engine crankshafts per hour at 100% efficiency.

The overseas customer for whom the machine was built came to the U. S. and, specifically, to Snyder for this cost-cutting, labor-saving machine because of the availability of definite benefits. These include previous experience of Snyder's ability to successfully adapt high-production, cost-cutting techniques to limited production quotas, long experience exclusively in the special machine tool field, domestic and export, and appreciation of Snyder's fresh and creative approach to *any* production problem. There were also the factors of Snyder's engineering and plant resources, assuring fast action and a delivery schedule probably not possible outside the U. S., and the availability of Snyder's standard units, pre-engineered and widely applicable. These same advantages are available to you. We'd like to hear from you.

SNYDER
CORPORATION

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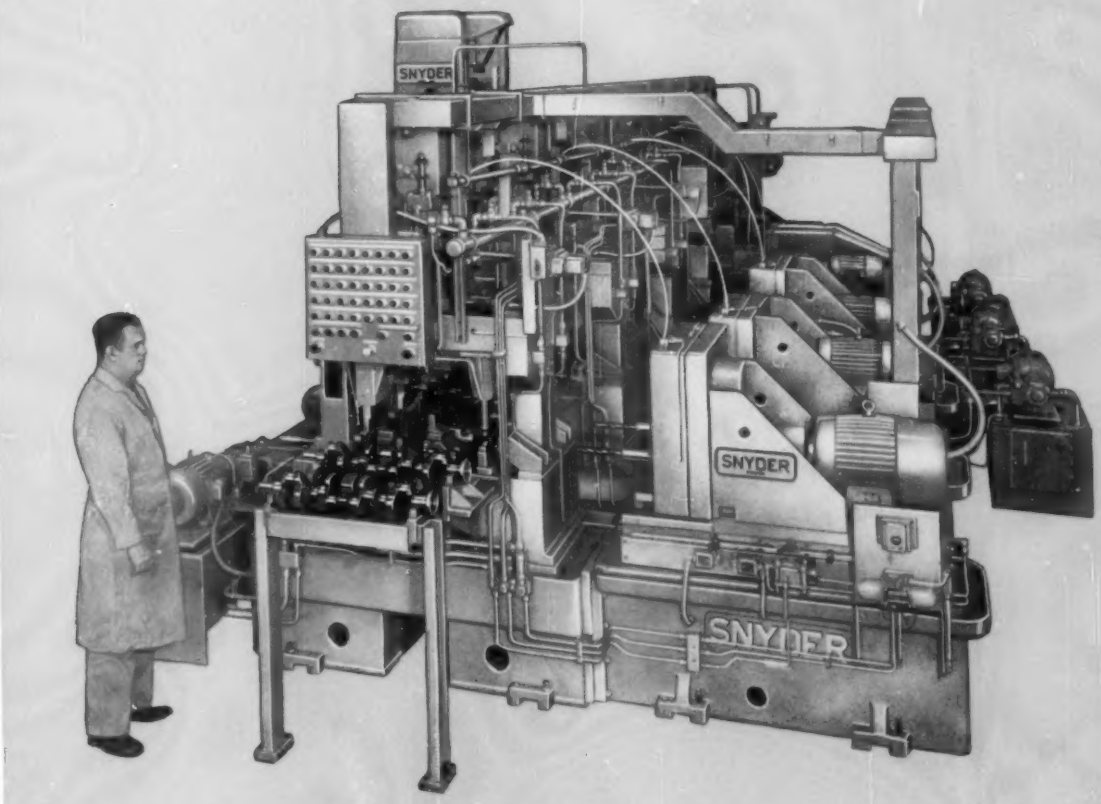

COOK OUTS and two Verson presses help balance production at Structo Manufacturing Company

Seasonal production problems can be tough and costly. Structo Manufacturing Company, Freeport, Illinois, solved such a problem. As the world's largest manufacturer of heavy gauge steel toys, Structo balanced its production of toys for the Christmas market with the production of barbecue grills for the summer market. Two 350 ton Verson crank presses are the key units in the grill production set up.

If you have production balancing problems, talk to your Verson Representative. He will be glad to show you how Verson equipment can help you in balancing production.

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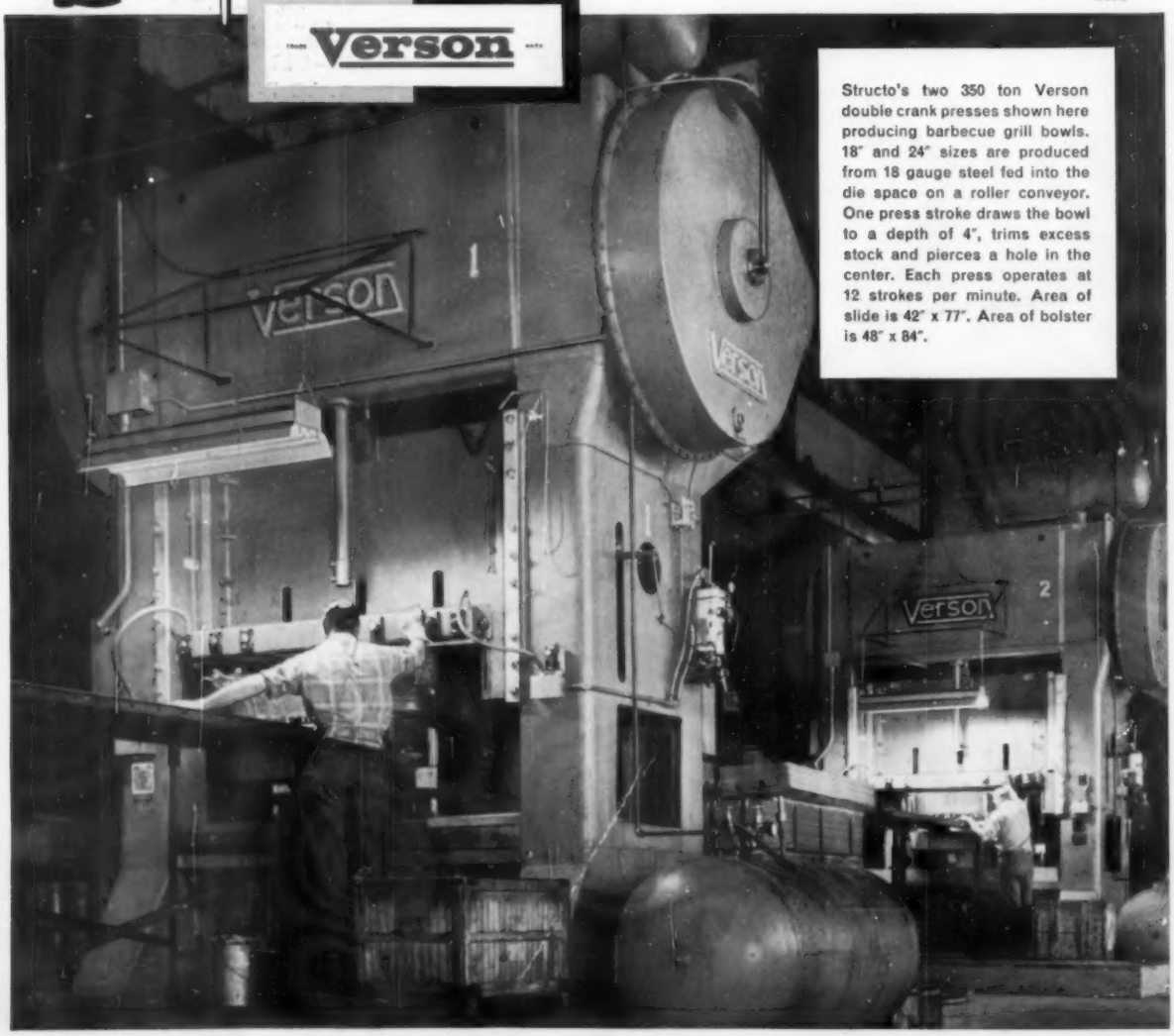

Structo's two 350 ton Verson double crank presses shown here producing barbecue grill bowls. 18" and 24" sizes are produced from 18 gauge steel fed into the die space on a roller conveyor. One press stroke draws the bowl to a depth of 4", trims excess stock and pierces a hole in the center. Each press operates at 12 strokes per minute. Area of slide is 42" x 77". Area of bolster is 48" x 84".

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